Factory

MANAGEMENT AND MAINTENANCE

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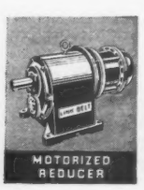
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Factory
MANAGEMENT AND MAINTENANCE

L. C. MORROW
Editor

Another Machine

That Will Raise Standard of Living

A COTTON PICKING machine carries on the industrial revolution. What a variety of thoughts, hopes, and fears must be following the recent announcement of its successful operation. Depending upon the viewpoint of the individual, perfection of this machine portends more unemployment or less unemployment, reduced markets or increased markets.

It is likely that all these results will follow when the machine is used on a wide scale. There will be unemployment among pickers. There will be loss of market for the farmers who now produce the feed for many more horses and mules than will be needed in a mechanized cotton country.

But there will be increased employment in the cotton processing and cotton goods manufacturing industries, because of the lower prices for raw cotton. And with increased cost advantage our cotton states are likely to get a bigger share of the international market. Also, by no means to be overlooked, the savings to consumers of cotton goods will be available for the purchase of the products of other industries.

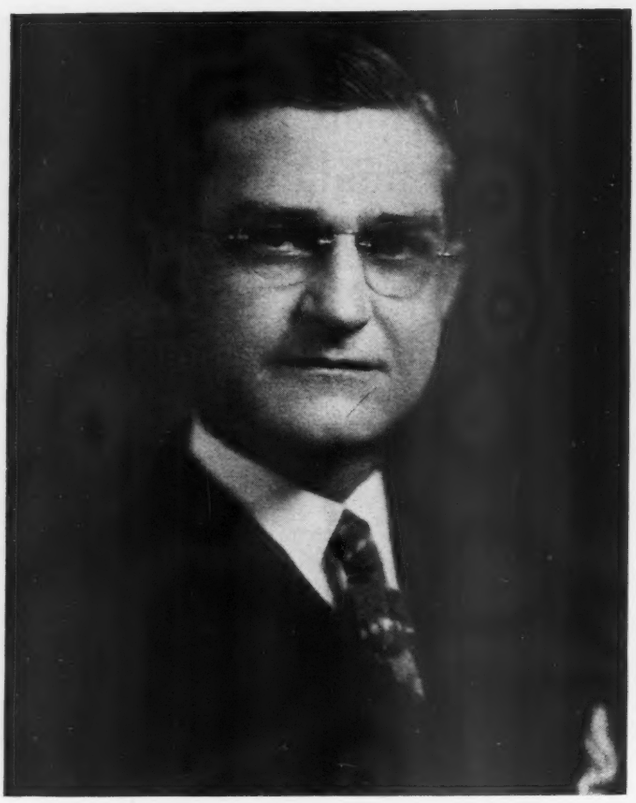
In the long run the cotton picking machine will be an important contribution to economic progress. In this day and age it is the highly mechanized industry that affords its people a high standard of living. The mechanized industries contribute most to the nation's wealth, therefore do most to raise the standard of living for everybody.

Hand-made products cannot compete with machine-made products of the same kind. Nor can a hand-labor industry compete with a mechanized industry so far as the welfare of its people are concerned, whether it be the same kind of industry or another.

These are economic facts that have been proved so often that we must accept them. But we must accept, also, the fact that complete mechanization in cotton picking will affect some part of the employment of 7,000,000 people. There is, therefore, a transition problem to be faced. However, cotton picking is a seasonal occupation, and the advent of machine picking will not affect the other kinds of work that the pickers do when they are not picking cotton.

Fortunately, the inventors of the machine are resolved to introduce it slowly and with definite restrictions on its use. Fortunately, also, the machine is not being set down at once in the fields as a perfect cotton picker. Its refinement will take years, so that the benefits of mechanization will not be too much impeded by the drawbacks of unemployment.

Tell the Employee and Tell Him Why



Charles R. Hook

ARMCO'S management has operated for 36 years on the theory that if you solve the human problems you have gone a long way toward solving the material problems. Those of us who in 1936 are just beginning to realize that better employer-employee understanding is the key to industrial harmony and progress may therefore profit by sitting momentarily at the feet of a master of the fine art of winning and keeping the confidence of the men on the job

THE GREAT NEED of today in every phase of our social, political, and economic life is understanding. I have long held this belief, but today the need is greater than at any time in the experience of several generations. We hear all sorts of charges, no matter how unreasonable, hurled at business and industry—to a large extent by agitators who seek to establish a "nuisance value" that will permit them to get a share of the fruits of production which they did not help to produce. Unless the management of business and industry considers it a major part of its responsibilities to enlighten "the man on the job," as well as all others dependent upon industry, with respect to fundamental economics and their mutual responsibilities, misunderstanding is apt to exist which is costly to employees, company, stockholders, and the community alike.

Enlightenment of the man on the job will bring about a better understanding, and in my opinion is the soundest means of winning and maintaining lasting friendship and cooperation. I believe, too, that it is the key to industrial progress. After all, when you solve the human problems you have gone a long way toward solving the material problems.

In the early 1900's this country

Whenever personnel men get together, someone is sure to chip in with "Now ARMCO does it thus-and-so." There's a reason; it is generally conceded that no industrial concern has done a better human relations job. For 32 years it has had employee representation. For 17 years it has published company policies. Its employees have always known exactly where they stood

An interview with

CHARLES R. HOOK

President, The American Rolling Mill Company

By ARTHUR VAN VLISSINGEN, JR., Consulting Editor

had no highly developed systems of transportation and communication as we know them today. But we in the steel industry did have our own particular means of knowing what was going on in other plants—we had our grapevine telegraph. And over the grapevine came word that the management of the new steel plant that had been established in Middletown, Ohio, had some unusual ideas about relations with men.

I was a hot mill foreman in a tin mill at that time and working "extra" as a roll turner. Rolls had to be turned in the housings on Sunday as we had no cranes in the plant. When Mr. George M. Verity called me to Middletown to discuss his ideas and proposed employing me as sheet mill superintendent, I was sold on his ideas with respect to policies that should govern employer-employee relationships and the opportunity for accomplishment under these policies, so it did not take me long to decide to accept his offer. Some of my associates thought I was very unwise to give up a place in a large going concern to take a job in a struggling little plant which had only started operations a short time before.

As a workman in the mills I had felt that if it were possible to win the cooperation of the men, so that men and management would be working for a common purpose, both would mutually profit. It seemed to me that if we could arrange some simple medium for the free and easy exchange of information, understanding would result and the vast majority of our problems would disappear.

I started to work for ARMCO on the first of November, 1902. At the end of eighteen months, after observing the number of complaints and grievances covering wages and working conditions that seemed to be due largely to a lack of understanding both on the part of myself and workers, I decided that we needed some more or less formal plan that would provide the means of regular contact for the discussion of our mutual problems and responsibilities.

At a general meeting in the summer of 1904, I outlined my thoughts to the men and asked them to elect a committee to meet with me regularly. For the want of a better name, it was called the Advisory Committee.

For several months this committee had dinner and conferred with me every Saturday night in the local hotel. It was extremely interesting to note how complaints and grievances disappeared as the men became better informed with respect to the problems of management. Mutual confidence and understanding were the result of this conference plan. Questions were settled before they became grievances and sore spots.

Finally the regular weekly meetings were discontinued, and we had regular monthly meetings unless there were special cases which either the management or the men wished to have discussed. So began an employee representation plan which has existed from that day to this.

As the company grew in size and

new plants were built or acquired, it became evident that a still more formal plan was required because the general manager could no longer meet each month with the general committee of each plant. During the past several years, therefore, the employees in each plant have adopted an employee representation plan of their own.

Even in its earliest days there were many outstanding illustrations of how employee representation served the mutual interests of both the company and the men. For instance, we had a balky engine that drove the sheet mill train in those days. This engine was underpowered, and great care had to be used in order to coordinate the work of the different mill crews or else the engine would stall. When it stalled, the men, who were paid on a tonnage basis, lost wages and the company lost production. Neither could afford the loss.

Our company was not able to buy a new engine, so rules had to be made covering a sequence of operations. All the crews were to alternate. This worked very well until someone would forget, and then the engine would stall again. It was next to impossible for me to find the guilty man in such cases for the men would never tell.

Never since ARMCO began its operations has the company lost a pound of production, never have its employees lost a moment's time, because of a labor dispute. Credit its enlightened industrial relations program. And credit its constant effort to tell the man out in the plant what and why

Employees Solved the Problem

Finally I asked the employee representatives' advice. They said "Let us handle that problem." And they *did* handle it, too. They made a rule that any roller who stalled the engine would be automatically laid off for three days, and they were far more severe in enforcing that rule than I could ever have been. Furthermore, when an unfortunate roller stalled that engine, they knew immediately who was responsible.

One morning as I was coming into the mill I met the chairman of the committee hurrying out of the mill.

"What's the matter, Billy?" I inquired. "Are you sick?"

"No," replied Billy. "I just stalled that damm engine, so I laid myself off for three days."

About that same time we were developing our commercially pure iron, a development attended by many costly disappointments. The success or failure of this development was of tremendous significance to our company and to the organization. We did not hesitate to discuss the problems of developing this new product with the representatives of the men. We told them that if this product was successful it would increase employment and make almost certain the future success of the company. If it failed, all of us might be looking for jobs. They responded in fine spirit, just as they have responded on innumerable occasions since that time. In the 36 years our company has operated, we have never lost a pound of production and the men have never lost a moment's time because of a labor dispute. ARMCO men are just as interested in preserving that record as the management. We trust each other. We have confidence in one another.

After more than 32 years' experience with employee representation I feel confident in saying that the vast majority of men are fair-minded. They want to do the right thing and they will do it if they understand

(Continued on page 78)

How the Courts View the Labor Act

J. A. GERARDI
Counsel, McGraw-Hill Publishing Company, Inc.
Member, New York State and District of Columbia Bars

RECENT decisions in the United States Circuit Courts interpreting the National Labor Relations Act are of considerable significance. From these one is compelled to conclude that even if the act is ultimately held to be constitutional, it will be so restricted in its scope that it will gradually become innocuous, or be repealed. Of course none of these decisions is final. All are subject to appeal to the Supreme Court of the United States. Nevertheless they give a fairly good cross-section of judicial thinking, which is largely based upon pronouncements of the highest court in earlier cases involving the same broad principles as are involved in the cases dealing with the National Labor Relations Act.

Does the Act Apply?

Most of these decisions are in cases dealing with the question as to whether or not certain types of business activities come within the legal conception of transactions within or directly affecting interstate commerce, since it is universally accepted that only such activities may be subjected to the provisions of the act. These cases have arisen as a result of the attempt of the National Labor Relations Board to secure enforcement of orders issued by it pursuant to the act.

In the case of the Jones & Laughlin Steel Corporation, decided on June 15 in the U. S. Court of Appeals for the Fifth Circuit, the National Labor Relations Board petitioned the court to enforce an order requiring the steel company to reinstate certain discharged employees and to do other things in that connection. The company contended that since the employees were engaged in a manufacturing operation, the act did not apply. In upholding the contentions of the steel company, the court cited the decision in Carter *vs.* Carter Coal Company rendered on May 18, 1936, by the Supreme Court of the United States. The following language from the Carter decision was quoted:

One who produces or manufactures a commodity, subsequently sold and shipped by him in interstate commerce, whether such sale and shipment were originally intended or not, has engaged in two distinct and separate activities. So far as he produces or manufactures a commodity, his business is purely local. So far as he sells and ships, or contracts to sell and ship, the commodity to customers in another state, he engages in interstate commerce. In respect of the former, he is subject only to regulation by the State; in respect of the latter, to regulation only by the federal government. Utah Power & Light Co. *vs.* Pfost, 286 U. S. 165, 182. Production is not commerce; but a step in preparation for commerce. Shassaniol *vs.* Greenwood, 291 U. S. 584-587.

We have seen that the word "commerce" is the equivalent of the phrase "intercourse for the purposes of trade." Plainly the incidents leading up to and culminating in the mining of coal do not constitute such intercourse. The employment of men, the fixing of their wages, hours of labor, and working conditions, the bargaining in respect of these things—whether carried on separately or collectively—each and all constitute intercourse for the purposes of production, not of trade. The latter is a thing apart from the relation of employer and employee, which in all producing occupations is purely local in character. Extraction of coal from the mine is the aim and the completed result of local activities. Commerce in the coal mined is not brought into being by force of these activities, but by negotiations, agreements, and circumstances entirely apart from production. Mining brings the subject matter of commerce into existence. Commerce disposes of it. Carter *vs.* Carter Coal Company U. S. decided May 18, 1936.

Production Is Not Interstate Commerce

On June 30, 1936, the U. S. Court of Appeals for the Sixth Circuit decided the case of the Fruehauf Trailer Company, and held upon the authority of the Carter case and also the Jones & Laughlin case that the act did not apply to activities conducted in connection with the manufacture and production of trailers. It should be noted in this connection that trailers are articles manufactured for possible use in interstate commerce, but this fact was apparently considered of no importance by the court. The rule that manufacture and production is not interstate commerce seems so well established that it makes no difference whether the particular article manufactured

(Continued on page 81)

No statute on the books is of greater importance to the manufacturing industries than the National Labor Relations Act. Analysis of court decisions indicates that even if it "gets by" the Supreme Court, its scope will be greatly restricted

More and Better Plating in the Same

Conveyorized plating layout at National Cash Register Company accounts for:

1 Increased volume with no increase in floor space

2 Better quality through control of plating solutions and more effective handling methods

3 Enhanced appearance of plating department; no congestion

4 Improved working conditions; no dangerous fumes

5 One-way travel; no more backtracking

6 Daily schedules established and maintained

7 Inventories kept at lowest possible points

WITH THE advent of chromium plating and its increased application to National Cash Register cabinets and parts, we found our facilities were not adequate to handle the increased plating work satisfactorily, both from a quantity and quality standpoint.

Our method resulted in considerable congestion because trucks were used to transport the parts from one operation to the next. This work required the use of 350 floor trucks which alone consumed 5,000 sq. ft. of floor space on one floor. These trucks were of various sizes and the parts transported on them were wrapped in canton flannel to prevent scratching. This presented an untidy appearance, made it extremely difficult to maintain clear aisles, and interfered with ventilation and light.

A complete rearrangement was planned to remedy this condition. This involved relocation of present equipment, purchase of new equipment, and installation of a complete

Before the change—trucks in the background took up a great deal of room, and when loaded with flannel-wrapped parts never looked orderly

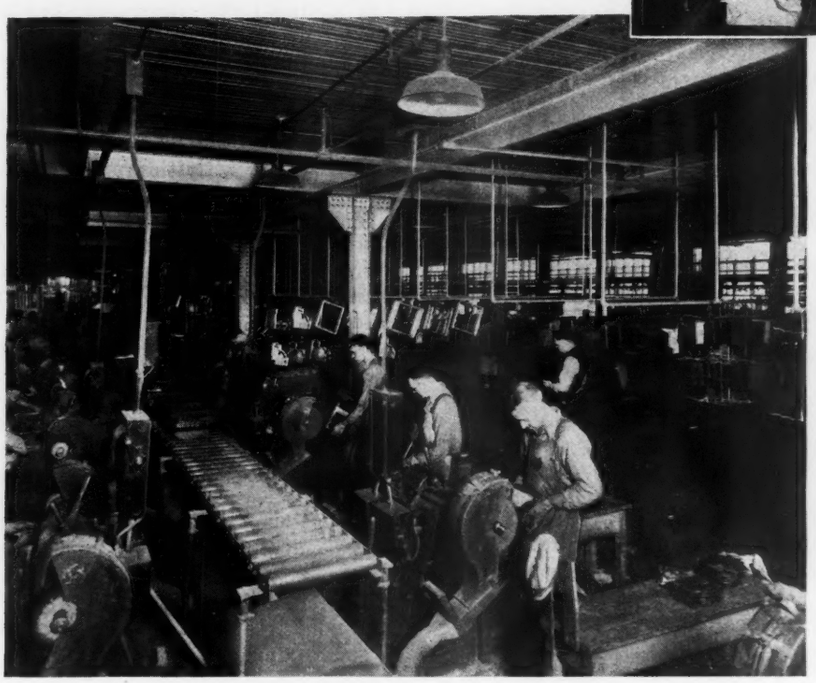
WALTER FRAINE
Foreman, Plating and Polishing Departments
National Cash Register Company
Dayton

Floor Space

system of overhead chain conveyors.

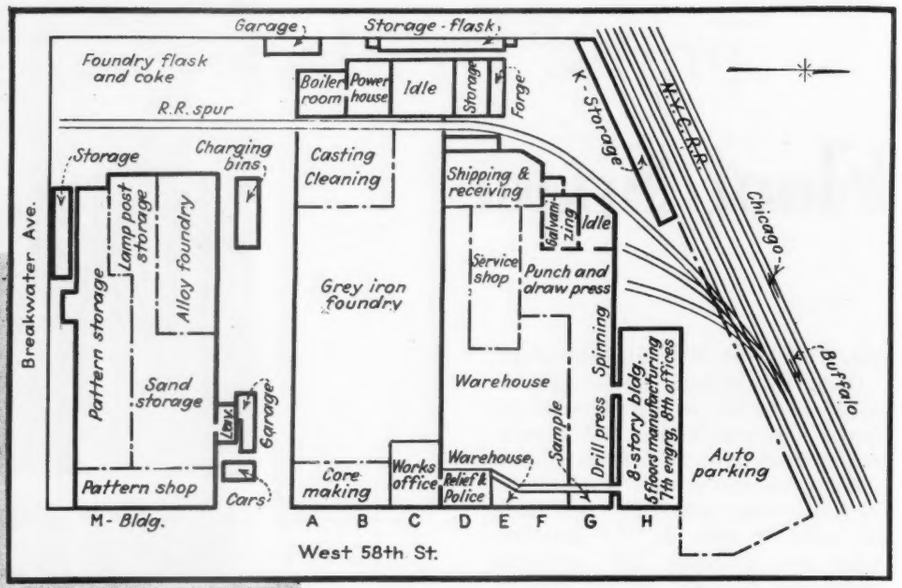
Under this system the daily schedule of parts to be plated is placed on the conveyor in the stock department. They proceed first through a cleaning operation and then to the polishing lathes where they are hung on racks in back of the operator. After five grinding and polishing operations, they are placed back on the conveyor chain and proceed progressively through the degreasing tank, automatic nickel plating machine, and nickel buffing lathes to the chromium plating unit. Here they pass through a series of cleaning tanks and are chromium plated.

Upon completion of the chromium plating they are again placed on the chain which takes them to the chromium buffing lathes and then through the final plating inspection where they are checked for all defects. From this point they proceed by conveyor to the finished-stock room where they are wrapped and stored subject to withdrawal by the assembly departments.



Polishing department (left) after the change looks both orderly and roomy. Day's quantity of parts to be plated is placed on conveyor in the stockroom, arrives here after passing through a cleaning operation. Once here, parts are removed from the conveyor on far side of the room and hung on racks behind the operators. After five grinding and polishing operations, parts go back on the conveyor chain, are brought to a degreasing tank and automatic nickel plating machine. Conveyor carries plated parts to nickel buffing lathes, which prepare parts for the cleaning tanks and chromium plating (above). The conveyor is at the upper left. Chromium buffing and final plating inspection (top) wind up the plating operations

C. F. HERBOLD
Plant Engineer
Westinghouse Electric & Manufacturing Company
Cleveland



New Layout for Job Orders Saves $30,000 a Year

Quick to criticize the concern that tries to squeeze quantity production out of a job order plant, we are sometimes slow to see the inconsistency in struggling with job orders in a plant laid out for mass production. Since the one may be just as uneconomical as the other, many a plant may profit from this account of how one company revamped its layout when the pendulum swung to job order production

TO MANY industrial plants rehabilitation has meant keying for a new trend in manufacturing—namely, job order production. The Westinghouse plant at Cleveland is engaged in the manufacture of lighting equipment, covering the entire field of illumination from ornamental lamp post standards and airway beacons to residential fixtures and marine lantern lamp changers. Recent transition in recognized lighting practice has indicated that, to obtain the best results for a given installation, standardized equipment cannot be universally applied. More often a special adaptation of line apparatus, which is almost the same as custom-built equipment, has accounted for a large portion of available business.

This plant was installed in reconditioned buildings in 1930 following a layout shown in Figure 1. On moving the activities of the lighting division to Cleveland the company expected an increase in business of 65 per cent over previous production. Building H was occupied by toolroom, storeroom, and box-making activities on the first of its eight floors. The second floor accommodated general assembly, packing, and main storeroom. Socket and detail assembly, testing, winding, stacking, and impregnating, together with a storeroom for their raw materials, were located on the third floor. The plating section, buffing and polishing, painting, and another storeroom occupied the fourth floor. The fifth floor was arranged to handle light machining operations, small punchings, and screw machine

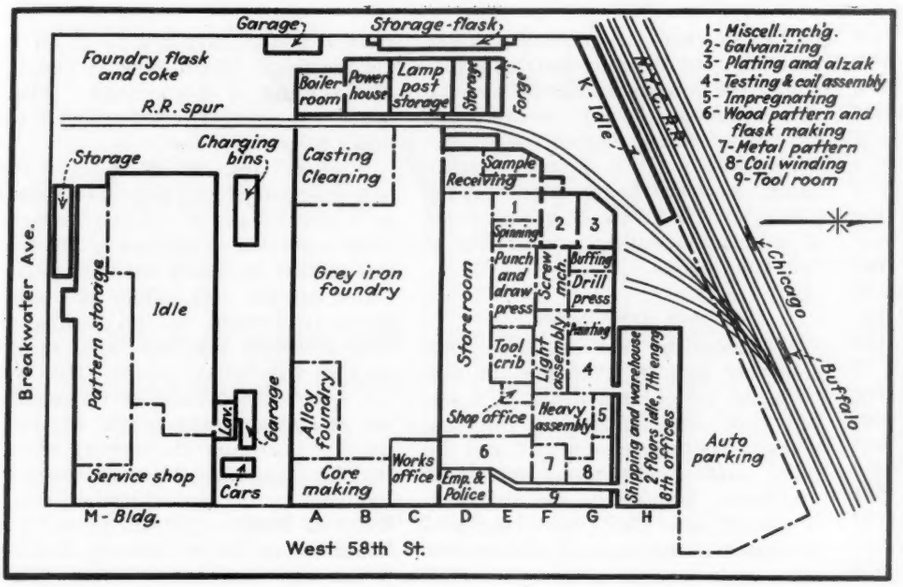


FIGURE 1. (Opposite page) Old layout. Its success was entirely dependent upon capacity load of line products. It did not lend itself to economic production of job orders

FIGURE 2. New layout. All manufacturing operations were moved from multi-story buildings marked H. Changes cost $50,000. Savings, approximately $30,000 a year

parts with a raw materials storeroom, and jig, fixture, and die storage. Special assembly work such as large floodlight and airway beacon construction was handled on the sixth floor. The seventh floor housed engineering department with laboratories; general offices and studios were located on the eighth. Storage of miscellaneous and bulky materials was placed in Building K.

With the manufacturing operations distributed over a series of floors as described above, material flow was a problem for deep consideration. To facilitate this handling problem, gravity conveyors were installed on each floor with spiral and vertical lift transfers between floors.

The capacity of the lighting division before moving to Cleveland was approximately 34,000 productive hours per month, and this new arrangement afforded the desired 65 per cent increase, or a calculated 56,000 productive hours per month capacity. The success of the 1930 layout was entirely dependent upon capacity load of line products and did not lend itself to the economic production of small lots and diversified or special orders, commonly called job orders.

Inefficiencies Began to Show Up

During recent years it has been this latter type of activity toward which the industry has inclined, with the result that the operating statement reflected in an emphatic manner the inefficiency of the 1930 layout. Handling costs were out of line with production, and supervision was extremely difficult over so many floors. Space allocations were far too generous, and duplications of machine tools joined with this to produce burden rates which in themselves constituted a tremendous handicap to economical production.

The advent of a new commodity, the Alzak reflector, made of aluminum, presented the problem of suitable location for the elaborate equipment in this unwieldy set-up. When all the handicaps of the 1930 layout were considered, the only possible conclusion was to make a survey and new plant layout, and from the costs and corresponding savings to determine the path to be followed.

Two plans were drawn up. The first was quite moderate in its scope and consequently involved a smaller expense. In return it promised little improvement over the highly inefficient existing layout.

The more extensive plan—the one that was adopted—involved the expenditure of approximately $50,000, not including the installation of the Alzak process. All manufacturing operations were moved from the multi-story building, and this space was used for warehouse facilities, with two floors remaining idle. Engineering and office allocations remained as before. The manufacturing groups are now located in Bays D, E, F, and G. (Figure 2). The alloy foundry was moved into available space in the grey iron foundry, thus eliminating a core transfer problem and releasing more expensive space in Building M. Drill press and machining operations previously classified as to size of work were combined, and this permitted the release of duplicate machine tools. The metal pattern shop was combined with the toolroom, thereby providing further economies in machine tools and coordination of man power. The contrast between the old and new layouts can be readily observed by comparing Figures 1 and 2.

A Handling Problem Solved

The manufacture of safety coils is one of the important operations of this plant. They are made in several types and sizes, and the orders are usually big enough to present quite a handling problem. An overhead chain conveyor has therefore been installed that picks these coils up as they leave the test board, carrying them first to the paint spray booth. They next pass to a baking oven and then up between the roof trusses, dropping at the far end of the plant to the packing section.

For the application of successive coats of paint, the coils are permitted to recirculate on the conveyor, and the baking is replaced by air drying on the straight run in the roof trusses. Other pieces of equipment are handled on the conveyor between the paint section and the shipping room. Especially during the summer months, the conveyor run in the trusses proves valuable for the drying of finishes that ordinarily bake at low temperatures, due to the increased temperature of the ambient. At some future date an A-type oven can be readily in-

stalled around this section of the overhead chain conveyor.

The arrangement as described above provides for a calculated 48,340 productive hours per month, based on a 40-hour week. Although the actual floor space per section is less than before, and despite the fact that in many cases fewer machines are required, it is felt that this capacity is equal to the calculated 56,000 hours for the 1930 layout by virtue of the difference in the allowed hours per man per week. It must also be kept in mind that the higher figure included certain nonproductive sections. Because less floor space is occupied and two complete floors of Building H are idle as well as approximately 69 per cent of Building M, the burden is reduced to the extent of $14,000 annually.

Quality Is Improved

Savings from the release of duplicate and obsolete machines account for an additional $2,100. The work of the time study department is at this time incomplete, but conservative figures based on the work thus far done indicate that the reduction in manufacturing cost due to the elimination of handling will mean over $15,000 per year. For example, from data now at hand the polishing and buffing departments have increased their earnings approximately 15 per cent. As a part of the arrangement, more efficient and adjustable dust collecting equipment was installed, and an average lighting intensity of 35 to 40 foot-candles provided by means of 400-watt high-intensity mercury lamps. The departments are thus enabled to produce a higher quality of work in less time, and in place of making only 80 per cent of their standard time task are now regularly producing 120 per cent.

With these three figures—which are conservative—the portion of the move chargeable as direct expense will be retired in less than 18 months. The difference between this amount and the entire cost is accountable in capital account for power lines, and racks and ovens which are covered by depreciation reserves.

Supervision Is Better

Improved supervision under the new layout is contributing its share to the success of the move. Under the previous arrangement the factory supervisor was continually traveling between floors and was difficult to locate when circumstances arose that required his immediate decision. Under the new layout his duties have not decreased in any manner, but he can be easily located. Furthermore, which is of greater importance, he can bring together the group leaders involved in both sides of a question with the minimum of lost time to all.

More Items Stocked

Warehousing has increased considerably due to a change in distribution policy as a result of a distribution cost analysis. Outlying stocks have been eliminated, and the plant now stocks many items of glassware previously not handled. Stocks of other items have been proportionately increased, a change that was made necessary by job order production.

To accomplish all this without requiring a vast amount of additional floor space, special storage racks were built of welded steel with expanded metal trays 3 x 10 ft., 5 ft. off the floor. Each rack is capable of carrying a 3-ton load. Floor space was doubled; crush effect from bulky piles eliminated.

"Before" and "after" views of the same section of the plant are shown in Figures 3 and 4. In the "before" view a portion of the heavy machining section is shown with the warehouse on the left, while the same space is devoted to the testing of transformers, reactors, and safety coils in the "after" view. The layout shows the possibility of moving the assembly groups to the adjacent floor of Building H, thereby allowing for expansion if more space is required by unexpected loads. Vacant floors of Building H still permit the handling of large airway orders, which are temporary loads. This change-over is undoubtedly similar to that undertaken by other plants, and is also an example of what still others might do to prepare for the economic production of job orders.

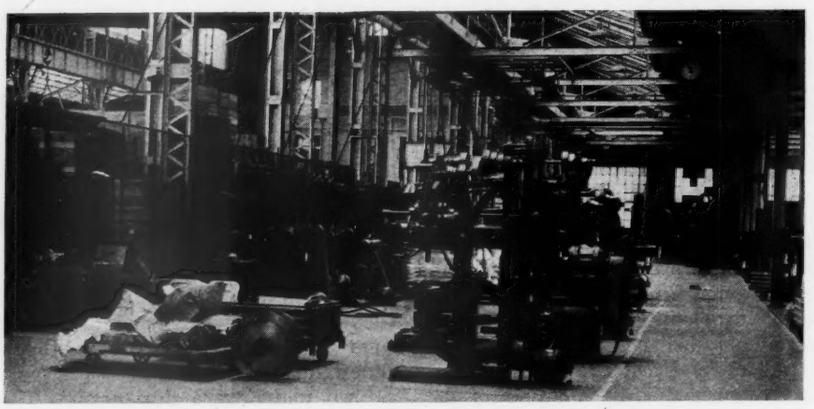


FIGURE 3. Before rearrangement of plant. Heavy machining section with warehouse at left

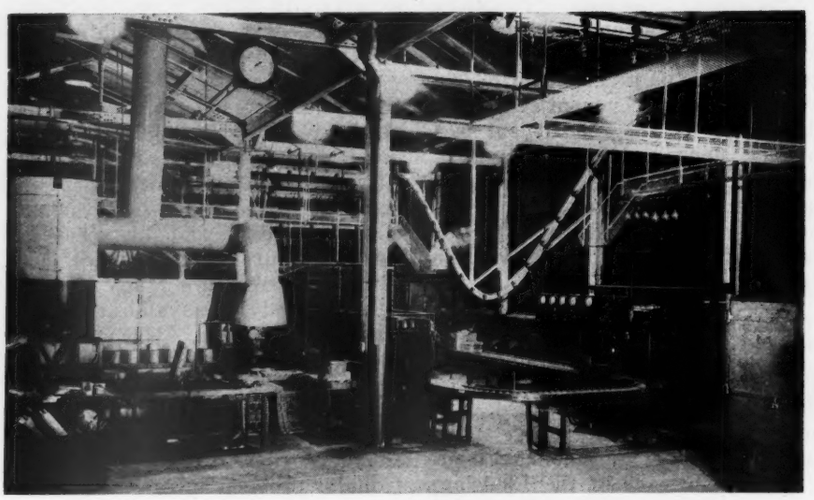


FIGURE 4. After. Same space now devoted to testing transformers, reactors, and safety coils

New Jobs for Old Workers

What do you do with older workers? With those who are disabled? Hudson finds useful work within their physical capabilities—work that makes them feel they are not "all through" but can still do a day's work

Charlie Morrow, boss of the rehabilitation department, is 70 years old and proud to be in harness. He keeps busy assembling instruction booklets and putting them in envelopes

ROBERT G. WALDRON
Personnel Director
Hudson Motor Car Company, Detroit

WHAT TO DO with the worker who, through injury or because of advancing age, is no longer able to perform his customary tasks yet wants to keep at work, is a problem in which industry is vitally interested. One approach to the problem is to weed out of the regular production work such jobs as may be handled by a man of this type without fatigue, and to create other jobs in which the workman may be usefully engaged.

At the Hudson plant we have a rehabilitation department, set up under the direction of the personnel department. Through its efforts, jobs into which these older men might fit were segregated. Special care was taken to pick out work in which they could find the pride of craftsmanship.

Workmen who, through physical incapacity, were unable to continue on jobs where it was necessary for them to remain on their feet, were placed at tasks where they might sit down. Other workers who were convalescing, yet wanted to do something rather than sit around the house all day, were given an opportunity to work at light tasks. Shorter hours were arranged in accordance with the men's physical condition. They really were allowed to "write their own tickets" and to work two, three, four, or eight hours a day according to physical capacity, until they were entirely recovered and ready to resume their old tasks.

This department is housed on the lower floor of a brick service building, neatly landscaped with shrubbery and flanked with carefully trimmed lawns. Here, segregated from the daily rush of the factory proper and yet close enough to enjoy some of the thrill that comes from association with the dynamic, pulsing hive of industry, these workers sit at their tasks of light assembly, placing washers on bolts, sorting parts, salvaging sweepings.

We All Slow Down

Directly in charge of this department is a man 70 years old, who occupies himself by assembling instruction booklets and placing them in envelopes. This is his sixteenth year with Hudson. He was hired when he was 54 years old. Then he was a production worker—and a good one. He liked his work and he wanted to keep on, but as everyone knows, we all slow down as the hands on the clock of life creep around to the three-score-and-ten mark. First he was given a watchman's job; then he was shifted to the department where he now finds the satisfaction of doing a good job himself and of helping others "find themselves."

Everybody around the Hudson plant knows Charlie Morrow. He is cheerful, sympathetic, tactful. If he had nothing else to do but hang around the house all day, he might become crotchety from the sudden drop from busy employment to a life of leisure. As it is, he is proud that he is still in harness.

In the same room are two other workers, both theoretically total disability cases, who have been given work within their capabilities. These men assemble main-bearing shim sets on pin boards. The jobs have been motion-studied to the point where a

Theoretically these men are totally disabled. Yet work has been found that they can do. The jobs have been motion-studied to assure a minimum expenditure of effort in reaching for loose shims

minimum of effort is required in reaching for loose shims in the bins. In the next room is another disabled worker doing a similar assembly job on connecting-rod shim sets. He is a big fellow—215 pounds—who has a special leather-seated chair to bear his weight. His trouble is a foot injury, and he gets around on crutches. Before him is a pin board on which the shim sets are made up, then slipped on a long spit. This man has big, clumsy hands, but he gets along surprisingly fast. There is no incentive here other than to keep busy. The point is that he is happy at his work. He knows that he is useful, and he too takes pride in a job well done.

Other jobs typical of the work assigned men such as these are those of assembling nuts in a recess in rubber door bumpers, salvaging small parts like bolts, nuts, washers, and light gaskets from factory floor sweepings.

In addition to the work within this department, work is found for some of the men back in the departments where they worked before they were incapacitated. Most of these workers are men who are on the way back to complete recovery, and they work alongside of their former fellow workers at jobs that they, in their temporarily incapacitated stage, can handle until they are completely recovered. It somehow makes a man feel that he is more necessary and better appreciated when he can work in his old department instead of being asked to perform some unfamiliar operation among the older and more permanently disabled men. In this category, four men are now sorting bolts on the Terraplane assembly line. Two more assemble a flat washer and a lock washer for the fender lace bolts.

Paid by the Hour

Workers in the rehabilitation group are paid on a straight hourly basis at a rate that depends to some extent on the man's service record and his last production job. These rates compare favorably with the average pay of workers on similar jobs in the plant.

Mention has been made so far only of simple routine jobs. Obviously, there are also highly skilled jobs done by older workers. There are many jobs in the factory where age and experience make a man more and more valuable. Some of our oldest men are in the pattern shop and in the tool and die department. Age mellows the true craftsman and sharpens his critical estimation of his work. Industry needs the older men in the shop.

•

Census Bureau Shouts Its Wares

A NEW policy of closer contact with industrial and trade organizations is being inaugurated by the U. S. Bureau of the Census. Services of its representatives are now offered to any convention of any size anywhere in the United States.

At present the Bureau has men at the Texas Centennial, Metal Products Exhibition in New York, and the Great Lakes Exposition at Cleveland. They are there to distribute publications and to answer all questions concerning the Bureau's services. Industrialists may thus acquaint themselves with the veritable gold mine of information that the Bureau has to offer.

A foot injury keeps this 215-pounder from the main production line, but he finds satisfaction in this light job of assembling shim sets on pin boards

Cost Fumbling or Cost Engineering?

ROBERT S. DENHAM
Chief Engineer
The Denham Costfinding Company, Cleveland

Horse-and-buggy days are gone. Machines have largely replaced hand labor. Yet most of us, charges Mr. Denham, still lump all other expenses except materials into something we call "overhead" and apply it as a percentage of direct labor. Each expense item, he avers, can be charged to the product benefited as accurately as the corner grocer charges his customers with pounds of sugar or packages of breakfast food

SHOPS were small in the bygone era of handicraft in industry and the product was laboriously made by hand. Prices were made by estimating the outlay for direct wages and materials, and adding to the total whatever further amount it was believed the customer could be persuaded to pay. Each shop served only its neighborhood, and competition was a negligible factor.

Today, machines have largely displaced labor, yet more than 90 per cent of all American manufacturers still assume that direct wages are a basic factor, and that all other expenses, except materials, can be combined in a mass termed "overhead" or "burden," and applied as a per cent of direct wages.

Rational costfinding is relatively simple. Its calculations require only simple arithmetic. But, like other sciences, it must be learned through patient study and application. No glib formula such as "direct labor plus overhead plus materials equals cost" will serve. Since every error in pricing, whether overcharging or undercharging, tends to destroy the profits of industry, it follows that the effort and expense of learning or acquiring correct methods will pay huge dividends.

Costfinding Facts

Before industry in general can make any marked progress in modernizing its economic practices, there are several more or less surprising facts that must be accepted:

1. Industrial costing is a function of engineering rather than of accountancy.
2. Since no other expenditure is involved in the ratio of direct wages, the use of "direct labor" as a basis for applying other expenses is misleading and productive of losses.
3. The creation and distribution, by any method, of generalized expense groups such as are commonly called "overhead" or "burden" actually defeat costing effort, because such methods invariably overcharge some products and undercharge others.
4. "Gross profit" is a myth, because profit is always net.
5. Profit percentages always relate to selling price or to sales. They should never be considered or calculated as a per cent of cost.

Cost engineering is the science of costfinding by analysis of product and the processes involved in production, and the charging of particularized (not generalized) expenditures to product, through process-unit rates, in the exact ratios of their utilization.

The science of cost engineering is based upon six principles as fundamental as the laws of numbers. These principles are:

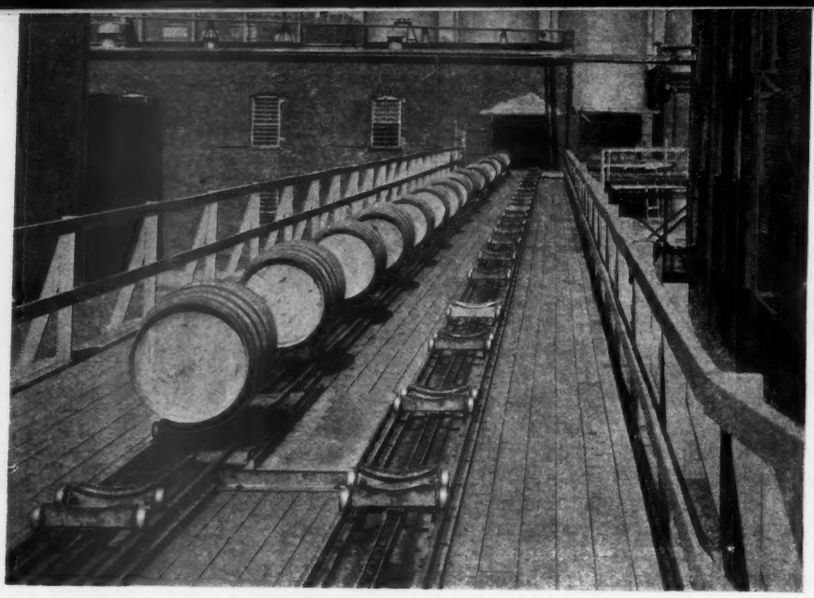
1. *The cost of an item of product is the sum of the expenses involved in its production—nothing added, nothing omitted.* When product is sold its cost includes, in addition to the expenses involved in production, all the expenses involved in handling and marketing it.

2. *Every expenditure is definite, and its object is a benefit.* Expenses are the elements of cost. Each expenditure is a definite amount of money expended for a definite measure of a definite service or commodity required for a definite use or need. Unless the amount of money involved, the objective of the purchase, the measure of purchase, and the measure of use, in relation to each expenditure, are known, costing cannot be accurately accomplished.

3. *Two or more expense items can be added together and the group total apportioned only when all the items have the same objective, a common unit of measure, and their benefits accrue in identical ratios.* All theories of "overhead" or "burden" distribution flagrantly violate this principle by grouping unrelated expenditures.

4. *In the apportionment of an indirect expense item, or a properly combined group of indirect expenses, the ratios of the benefits conferred indicate the ratios of the charges to be made to the beneficiaries.* This statement presents the key principle of sound industrial costing. It is simply the age-old principle of equity in exchange, used in trade ever since tokens of value (money) came into use. While it applies

(Continued on page 83)



Barrels of whiskey can be rolled. But they weigh around 500 lb. apiece and that's a lot of rolling when daily production is 1,000, perhaps even 2,000, barrels—as it is some of the larger distilleries. Newer, better, safer way of handling barrels is by the single-strand endless chain conveyor. This one is in the American Distilling Company's plant at Pekin, Ill., and is used to move barrels to and from the bonded warehouse

New Handling Quickens an Old Industry's Comeback

This live roller conveyor picks up filled cartons from the bottling lines and carries them through this twin-scale operation where the weight is stamped on each carton. The two lines then converge and the cartons are fed into a single chain conveyor that takes them on to storage or shipping. Note the chains with pushers so spaced that cartons are fed in alternately—first one from one line, then one from the other

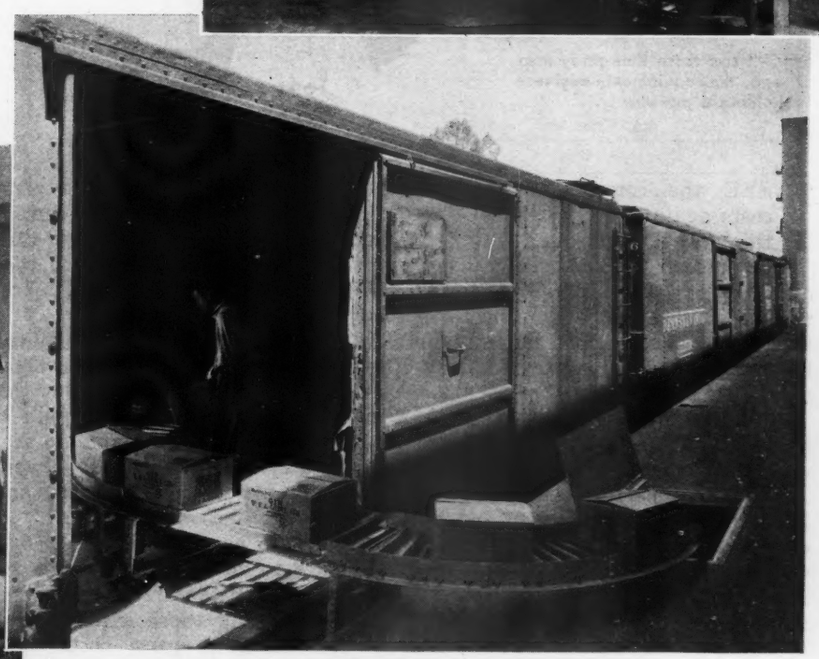
ONE NICE THING about going out of business for a while is that when you start up again you can take advantage of all the newest and best equipment that has been developed in the mean-

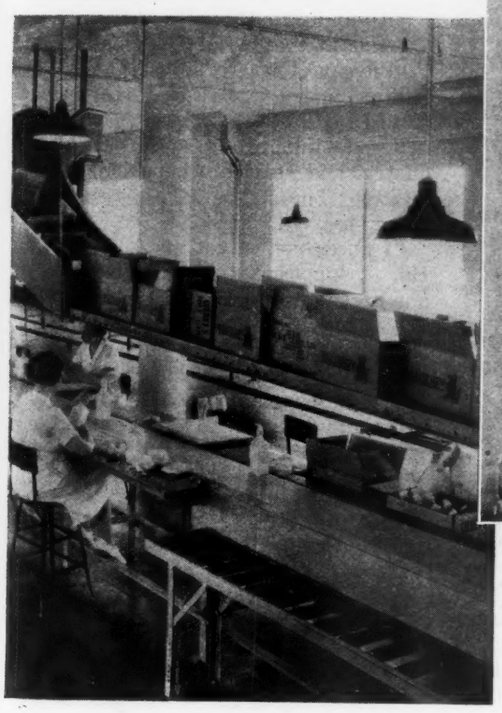
Bottles are taken from the cartons, washed, filled, and go to the labeling tables. Here girls sit on either side of a rubber belt conveyor, lift the bottles to the maple work board in front of them for labeling, wrapping, and inspection. A carton is taken from the overhead gravity roller line, placed on a gravity roller packing section beside the conveyor, and filled. Filled cartons move via gravity rollers to sealing machines

Barrels ride on dollies, are easily rolled on or off at necessary loading and unloading points. This conveyor is teamed up with a double-strand chain elevator that serves some nine or ten storage floors in the rack house. Between the two conveyors practically all manual handling has been eliminated. There is never any heavy hauling

Dumping whiskey into a filter tank is now a continuous process. Barrels are carried slowly over the tank in cradles that consist of four rollers (with anti-friction bearings) mounted in twin strands of conveyor chain. At the loading end the bung is knocked out and the barrel is easily rotated so that the hole is down in a position to discharge the whiskey into the tank. Conveyor speed is regulated so that the barrel is completely emptied just before it reaches the end of the tank, where it is discharged over the conveyor end sprockets for processing and re-use

time. That is precisely what happened in the distilling industry. Today, in the matter of mechanical handling equipment, for instance, we find it second to none





Bottles arrive in carload lots in the same cartons that will later be used in final shipment. At the Gilbey Gin plant of National Distillers Products Corporation in Cincinnati, a section of gravity roller conveyor is set up in the car. Cartons of empty glass are easily and quickly loaded to the conveyor, slide down a chute to a belt conveyor that feeds gravity lines running the length of the basement storage area

If the worker only knew

Would he believe there are only so many jobs?

"I saw those time-study men and the equipment engineer holding a powwow . . ."

"I SEE the company is cutting costs again, Ed. Where do they think we'll come out?"

The speaker is Sam, planer hand, and he is addressing his fellow worker, Big Ed, as they stow away sandwiches and coffee during the lunch period. They are seated alongside Ed's big planer.

"What do you mean, 'cutting costs,' Sam? And even if they are, what does that have to do with us?"

"Well, it's perfectly plain to me. I saw those time-study men and the equipment engineer holding a powwow in the milling department this morning. And I know what that means—new machines that'll throw a coupla us fellows out on our ears. That's what it has to do with us. Enough, ain't it?"

"Now, Sam—I thought you'd got rid of those ideas. You know perfectly well *this* firm doesn't throw men out on their ears. A couple may be moved away from milling, but they'll still have good jobs. And if we don't cut costs, how can we keep our prices down to meet competition? And if we don't do that, how can we get the orders to keep anybody employed?"

"Oh, I know, Ed—the usual arguments. I guess you're right about keeping the men on here. But that means a coupla extra men won't be hired. And if all the plants do that, a lotta people won't have work. There's only so much work, anyway. Why not divide it up?"

"So that's what's eating you. Okay, I'll have to go over some of the old arguments. In the first place, there's no use putting those extra men on if it's going to raise costs. The higher the costs go, the less we sell and the fewer the jobs. We've got to *lower* the prices so we can sell more, in order to give those extra people work. And—"

"But, Ed, what makes you think we can sell more? There's a limit to what can be used, isn't there?"

"Yes, I suppose there is. But we haven't seen it yet—or anyway near it. Do *you* know anyone who has everything he needs or wants?"

"No, can't say I do. Can't say I see how they're going to get it, either."

"Here's one way, Sam, and I guess it's the only way: Keep improving methods and machinery so that we can get costs lower and lower. Reduce selling prices as costs go down. Then more will be sold, more will have to be made, and there will be more jobs."

"Sounds all right, Ed, but how *many* more jobs? Enough to really amount to something?"

"Sure. There's an easy way to measure it. Just think back to 1929—we didn't believe people lived too well then, did we?"

"No."

"Well, suppose we had 1929 standard of living today. Factories—and I mean *factories* alone—would have to make so many more products that they would employ between 10 and 11 million people, instead of the less than 9 million they now employ."

"Yes, that's a million and a half more jobs. What then?"

"All right. Suppose we raised everybody's standard of living 25 per cent. We'd put on another 2½ million. Then if we kept on going, getting the standard up to 50 per cent above 1929, we'd add still another 2½ million workers."

"That gets you up to where, Ed?"

"Right up to 15¾ million, Sam."

"And is that a lot?"

"I'll say it is. It's just about 5½ million more than factories employed in 1929—their best year. And it doesn't take into account other industry, and service occupations, and selling. There'd be a lot more jobs there, too, you know."

"I guess you've got me sold again, Ed. I suppose you got those figures out of some of the books you're always studying. Hope they're right."

"Yes, I did get them out of books. And they're right, I guess. At any rate I know they're based on government figures. There goes the whistle, Sam. So long."

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The series to date: 30-Hour Week; Townsend Plan; Labor Relations Law; Taxes; Mechanization; Employee Representation; Profits; Security; Employment. Available in 3x5 pamphlet form for management to distribute to workers.

200 Key Men Took Motion Economy

PART THREE

★

PROF. MYRON A. LEE
Head of the Department of Industrial Engineering
Cornell University

TWO MORE examples of improvements effected in operations as a result of the course in motion economy conducted at International Business Machines Corporation serve to show the possibilities in this method of attacking the production cost problem. How the course was set up and conducted was told in July (p. 248), and two examples were given in September (p. 40) of how the foremen, assistant foremen, and keymen who took the course then went back to their work and applied what they had learned. This article completes the series.

Operation No. 1 was to burr-counter sink and tap small hexagonal part shown in Figure 11. Process charts of the old and improved methods are shown in Figures 12 and 13. Under the old method the part was placed in a collet and the collet partially closed. Stock stop *A* on turret, Figure 12, was then advanced to position part, and collet was tightened. Also there were three blank positions on the turret part which it was necessary to index by hand.

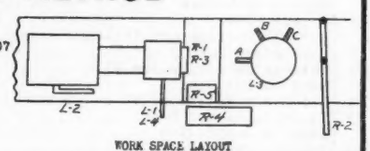
Result, a 38 Per Cent Saving

Under the new method a stop was placed in the collet to position the part. Thus the stock stop, *A*, Figure 12, was eliminated. A triplicate set-up of tools in the turret eliminated hand indexing past blank positions. The bar-stock feed mechanism was used to eject the finished part from the collet into a drop delivery chute, and blanks were conveniently located at *R*, Figure 13. The set-up for the new method is also shown in Figure 14. A 38 per cent saving in time resulted. In some cases it is

FIGURE 12

OLD METHOD

Part No. 113377 Oper. No. 7
Dept. No. 5 Mach. No. 307
Description of Oper. Burr-Countersink and Ream



WORK SPACE LAYOUT

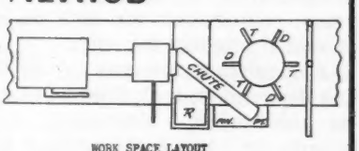
Left Hand	Right Hand
Idle (on collet lever, L-1)--	Transport part to collet, R-1
"	Position part in collet, R-1
Partially close collet, L-1--	Hold part in collet, R-1
Idle, (on collet lever, L-1)-	Reach for turret lever, R-2
"	Advance turret to position part, A
Tighten collet lever, L-1----	Idle (on turret lever, R-2)
Reach for clutch lever, L-2--	Index turret, R-2
Throw in clutch, L-2---------	Advance turret, B
Idle (on clutch lever, L-2)--	BURR--COUNTERSINK
"	Index turret, R-2
"	Advance turret, C
Reverse clutch lever, L-2----	TAP
Idle (on clutch lever, L-2)--	Withdraw tap, R-2
Stop Spindle, L-2------------	Back off turret, R-2
Bring hand to turret, L-3----	Idle (on turret lever, R-2)
Index turret by hand, L-3----	Reach for finished part, R-3
Reach for collet lever, L-4--	Hold finished part, R-3
Open collet, L-4------------	Transport part to container, R-4
Idle (on collet lever, L-4)--	Reach for next part, R-5
	Grasp part, R-5

Total time per piece 0.224 Minutes

FIGURE 13

NEW METHOD

Part No. 113377 Oper. No. 7
Dept. No. 5 Mach. No. 307
Description of Oper. Burr-Countersink and Ream



WORK SPACE LAYOUT

Left hand	Right hand
Idle (on collet lever)-------	Position part in collet
Close collet----------	Hold part in collet
Move to clutch lever---------	Move to turret lever
Start spindle----------	Advance turret
Idle (on clutch lever)-------	BURR--COUNTERSINK
"	Index turret
"	TAP
Reverse spindle----------	Run tap out
Idle (on clutch lever)-------	Index turret
Stop spindle----------	Move to pan of parts--R
Move to collet lever---------	Grasp part
Eject finished part----------	Transport part to collet
Idle (on collet lever)-------	Position part in collet

Total time per piece 0.138 Minutes

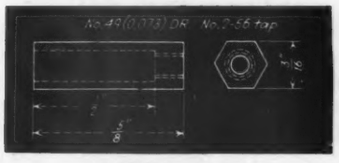


FIGURE 11

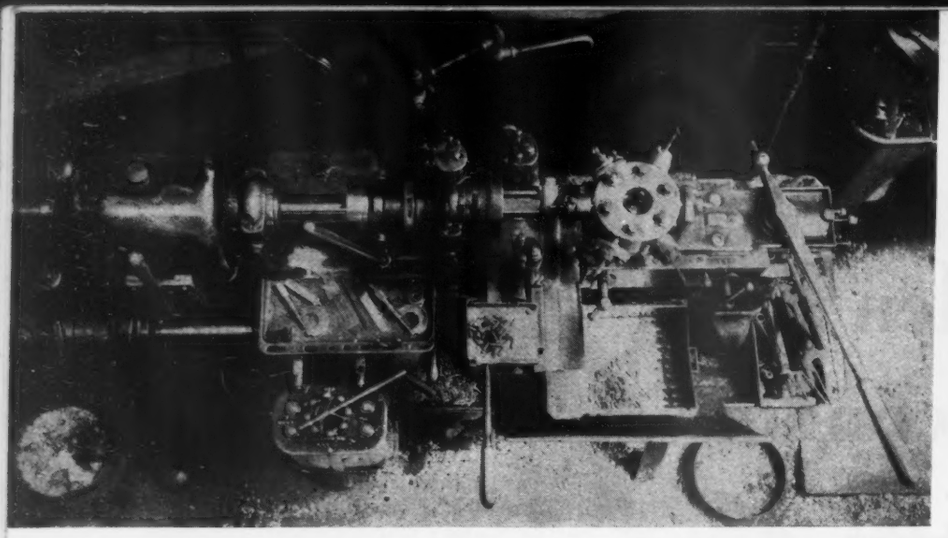
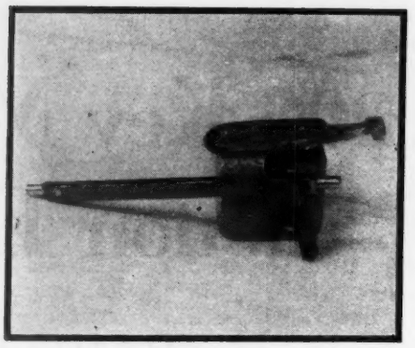


FIGURE 14

FIGURE 15



possible to eject finished parts by means of an air hose introduced through the headstock. This has an added advantage in that it also blows the chips out of the collet.

Drilling Operations

So many improvements were made in drilling operations that it is difficult to select a typical illustration. On the magnet armature shown in Figure 15 there were two operations which had been performed in the drilling department:

Operation 13—Drill and hollow mill. This consisted of drilling the holes *A* and *B*, Figure 15, and hollow milling the ends *C* and *D*.

Operation 14—Countersink and ream, countersink top side of holes *A* and *B* slightly for burr.

An assistant foreman in the drilling department took these operations as his project. Previously a six-spindle drill had been used for Operation 13 and a two-spindle for Operation 14. By the development of new hollow milling tools and drills it was possible to do both operations on a four-spindle drill. The work place was carefully rearranged, cutting oil piped to the tools, stops located on the table for positioning the fixture, and a drop delivery chute for finished parts installed.

Compare Process Charts

Since the course was intended for foremen, assistant foremen, and key men, emphasis had been placed mainly upon the application of motion economy to individual operations. However, the possible wider application to the entire sequence of operations on a part had been shown. By mounting a small disk grinder and some filing fixtures on the bench shown in Figure 16 it was found possible to do Operations 6 to 9, 11, 12, and 16 to 20 as well as Operations 13 and 14 in a comparatively small area. The resulting improvement in the entire process of manufacturing this part is shown by

OLD METHOD
PROCESS CHART FOR MAGNET ARMATURE

Oper. No.	Dept. No.	Operation	Distance Travelled in Feet: Between Oper.	Distance Travelled in Feet: Total
	50	Raw Stores		
		Move to Punch Press	100	100
1	8	Blank		
		Move to Heat Treat	120	220
2	2	Anneal		
		Move to Punch Press	120	340
3	8	Form		
4	8	Straighten		
5	8	Swage		
		Move to Elevator	200	540
		Up One Floor		
		Move to Burring and Straightening	300	840
6	12	Straighten for Straddle Mill		
7	12	Line Bearings		
		Move to Milling	240	1080
8	1	Straddle Mill		
		Move to Burring and Straightening	240	1320
9	12	Burr with File		
		Move to Elevator	300	1620
		Down One Floor		
		Move to Punch Press	200	1820
10	8	Form Hook		
		Move to Elevator	200	2020
		Up One Floor		
		Move to Burring and Straightening	300	2320
11	12	Straighten Post		
12	12	Straighten for Hollow Mill		
		Move to Drilling	280	2600
13	3	Drill and Hollow Mill		
14	3	Countersink and Ream		
		Move to Inspection	180	2780
15	40	Inspect Bearings		
		Move to Burring and Straightening	100	2880
16	12	Burr Ends		
		Move to Milling	240	3120
17	1	Mill Hook		
		Move to Burring and Straightening	240	3360
18	12	Grind to Length and Burr Hook		
19	12	Straighten and Line Gage		
20	12	File Hook 1st Fixture		
21	12	File Hook 2nd Fixture		
22	12	Burr Hook		
		Move to Inspection	100	3460
23	40	Inspect		
		Move to Elevator	200	3660
		Down One Floor		
		Move to Heat Treat	140	3800
24	2	Pack		
25	2	Carburize		
26	2	Harden Point		
		Move to Elevator	140	3940
		Up One Floor		
		Move to Burring and Straightening	300	4240
27	12	Scrape Lead		
		Move to Inspection	100	4340
28	40	Inspect		
		Move to Elevator	200	4540
		Down One Floor		
		Move to Stock	150	4690
	83	Store		

Scale—1" = 500'

FIGURE 17

"old" and "new" process charts, Figures 17 and 18.

At the International Business Machines Corporation the employees are given the opportunity to enroll for a wide variety of shop courses. This enrollment is entirely voluntary on the part of the employee and the courses are held outside of working hours. This procedure was followed in the motion economy classes.

The system of wage payment used at the plant is called "The Measured Day Work Wage Plan." The operator is paid at his regular hourly wage multiplied by the actual num-

FIGURE 15a

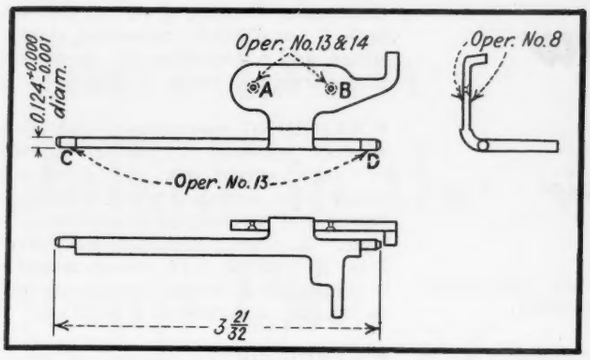


FIGURE 16

NEW METHOD
PROCESS CHART FOR MAGNET ARMATURE

Oper. No.	Dept. No.	Operation	Distance Travelled in Feet: Between Oper.	Total	Scale 1" = 500'
	50	Raw Stores			
		Move to Punch Press	100	100	
1	8	Blank			
		Move to Heat Treat	120	220	
2	2	Anneal			
		Move to Punch Press	120	340	
3	8	Form			
4	8	Straighten			
5	8	Swage			
		Move to Elevator	200	540	
		Up One Floor			
		Move to Drilling	200	740	
6	3	Straighten for Straddle Mill			
7	3	Line Bearings			
		Move to Milling	15	755	
8	1	Straddle Mill			
		Move to Drilling	15	770	
9	3	Burr with File			
		Move to Elevator	200	970	
		Down One Floor			
		Move to Punch Press	200	1170	
10	8	Form Hook			
		Move to Elevator	200	1370	
		Up One Floor			
		Move to Drilling	200	1570	
11	3	Straighten Post			
12	3	Straighten for Hollow Mill			
13&14	3	Drill, Hollow Mill, Countersink, & Ream			
		Move to Inspection	180	1750	
15	40	Inspect Bearings			
		Move to Drilling	180	1930	
16	3	Burr Ends			
		Move to Milling	15	1945	
17	1	Mill Hook			
		Move to Drilling	15	1960	
18	3	Grind to Length and Burr Hook			
19	3	Straighten and Line Gage			
20	3	File Hook 1st Fixture			
21	3	File Hook 2nd Fixture			
22	3	Burr Hook			
		Move to Inspection	180	2140	
23	40	Inspect			
		Move to Elevator	200	2340	
		Down One Floor			
		Move to Heat Treat	140	2480	
24	2	Pack			
25	2	Carburize			
26	2	Harden Point			
		Move to Elevator	140	2620	
		Up One Floor			
		Move to Burring and Straightening	300	2920	
27	12	Scrape Lead			
		Move to Inspection	100	3020	
28	40	Inspect			
		Move to Elevator	200	3220	
		Down One Floor			
		Move to Stock	150	3370	
	83	Store			

FIGURE 18

ber of hours worked, without regard to his output. The time study department establishes a standard time for each operation which permits the supervisor to determine the relative performance of his operators and this is a factor when considering wage increases. The performance of each operator and of each department is recorded and this furnishes the incentive for adequate production. Also it is the policy of the company to utilize savings in manufacturing costs very largely for the purpose of increasing wages so that all cost reduction work ultimately results in increased earnings for the workers.

The advantages of a motion economy program are manifold:

1. It is not essentially a method of driving the worker to a speed harmful to his health and well-being without regard to the quality of the product. Rather, it teaches the operator to do work in less time and with less effort. For this reason one may inaugurate a program without feeling that he is doing something detrimental to the best interest of the worker.

2. It is very easy to demonstrate the financial savings resultant from the program and thus insure the whole-hearted support of the management.

3. It is an educational movement with an appeal to the foreman and assistant foreman, for it has an immediate and direct application to their daily jobs.

4. It has definite possibilities in the promotion of a better understanding and desirable relationship between management and worker.

A Leader, Not a Driver

Management literature has stressed the necessity for the foreman to be an instructor and leader and not just a driver. After motion economy had been introduced in a department an assistant foreman told the author that his relations with his men had materially changed. He finds a man not making his rate on a job. Instead of telling the man to speed up a bit and leaving him surly and disgruntled, he suggests a rearrangement of his work place and a few changes in motions. When he returns after a time the man has a smile on his face and is meeting or exceeding the standard without difficulty. Is not this a direct and practical method of assisting the supervisor to be a leader and instructor instead of a driver—a movement in which any man or management may be proud to participate?

You want to know

and the editors will gladly tell you more about the things mentioned on this page

• BOOKLET, in which the American economic system is compared with collectivism and dictatorship, defines and explains main principles of the major "isms," contrasts them with the American ideal of private initiative. (10601)

• ROBINSON-PATMAN ACT — the most complete and thorough study of this much-discussed, little-understood law we've seen yet. It's intended to guide executives in adjusting company policies to conform with the law. Has fine cross-reference index. (10602)

• NEW OIL PAINT can be applied directly over calcimine without preliminary preparations of sizing and washing down. Claimed to be both sealer and sizer, it can be applied to give flat, semi-gloss, or gloss finishes, depending upon what you mix it with. (10603)

• HOW industrial distributors effect savings for industry is subject of a recent issue of a monthly publication serving distributors. By means of charts it traces the distribution of supplies from their manufacturers to the 300,000 plants using them. (10604)

• BAKING company does a good packaging job by packing fruit cake in container consisting of a black plastic tray and colored plastic cover. Lift cover, and cake is ready to be served without transferring to separate plate. (10605)

• DRY crystalline composition, placed in water- and fire-tube boilers while they are in operation, creates oxygen that burns off combustible matter in soot, carbon scale, and slag. (10606)

• FINISH for metal parts, applied by spray gun or brush and dried by air or baking, is claimed to be water-, sunlight-, weather-, and fire-resistant. It's insoluble in oil, not affected by dilute alkaline solutions or dilute sulphuric and hypochloric acids. (10607)

• PRINTING plates made of an oilproof, moisture-proof synthetic rubber are said to give good detail and to compare favorably with metal plates in point of service. They are economical in the use of ink, it is claimed. (10608)

• LIGHTING HANDBOOK, revised and enlarged edition, has seven sections dealing with different types of lighting. Interior, built-in, display, sign, flood, highway, and underwater lighting are treated. (10609)

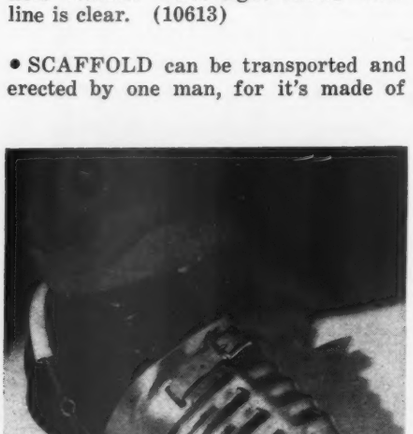
• RESEARCH in cast iron has led to a booklet on the strength and elastic properties of that material in tension, compression, and flexure, and in combined tension and flexure. Added feature is a bibliography of cast iron research. (10610)

• UNIVERSAL cleaner and stain remover, non-explosive and non-inflammable, cleans stains from porcelain, tile, terra cotta. Apply it with a cloth or sponge, let stand a few minutes, then rinse with water. (10611)

• FOR YOUR TRUCKS you'll want to consider a defroster fan which, it's claimed, defrosts the windshield in winter, removes steam in spring, cools in summer. Rubber blades make it safe, guard unnecessary. Mount it on steering column, header board, or corner post. (10612)

• TWO-WAY communicating system, with each unit self-contained, can be used with as many as 6 stations on the line. Lever operating control and variable volume. Pilot light shows when line is clear. (10613)

• SCAFFOLD can be transported and erected by one man, for it's made of aluminum. Consists of round platform in 5-, 6-, or 6 2/3-ft. diameters, clamps, slings, and a crossbeam for suspension from structural beams. (10614)



MADE of aluminum alloy or galvanized steel, this foot guard is light as can be. It's easy to put on, fits any shoe, cannot be kicked off, is fitted with silent tread and adjustable strap, can protect foot under 300-ft.-lb. impact. (10625)

• WEIGHING operations to determine whether material or product is over- or under-weight can be performed easily with a scale having rear-illuminated dial functioning on shadow principle. At center, indicator dial travels 2 in. to indicate 1 oz., which means it is sensitive. It doesn't have to be level to register accurately. (10615)

• HANDBOOK on design of metal parts for porcelain enameling and booklet on reflectance testing of opaque white porcelain enamels are two free technical publications available to those interested. (10616)

• DOOR or burglar alarm is operated by electric eye that rings alarm signal when light beam is cut. Operating range is 15 feet. (10617)

• NIGHT-DRIVING glasses will make the going easier for your drivers, diminish chances of accidents and damage. They are a special one-piece frame with a single sheet of colored glass cut to shield against opposing headlights, but permitting full vision of right half of the road. (10618)

• "MORE GOOD for More People" is title of a booklet extolling benefits of technological improvements. It shows that prices today would be far above present levels if we used manufacturing methods of 20 years ago. (10619)

• COPPER sandwiched between two layers of elastic asphalt forms a new building material valuable for termite-proofing and sealing in of structures for air conditioning. It comes in rolls and is said to remain flexible under all temperature conditions. (10620)

• NEW DESIGN wave has reached ink pads. A new one has spring cover, reversible and replaceable stamping surface, ink reservoirs, and a rubber base. You re-ink by pouring ink into two reservoirs in base, and thanks to the rubber base, the bang-bang-bang no longer accompanies stamping. (10621)

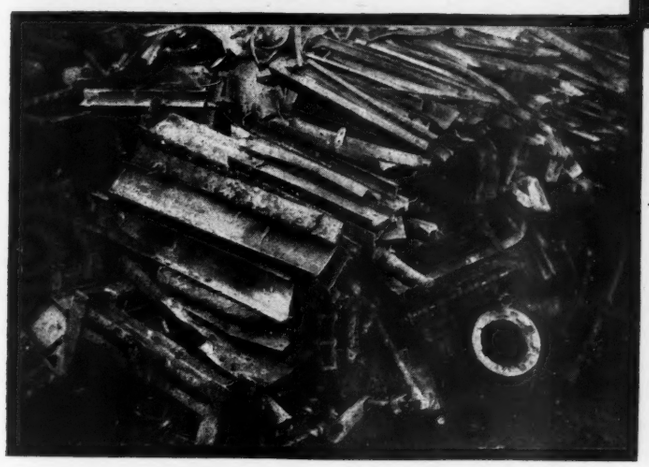
• STEEL-ROOFING—a useful handbook explaining and demonstrating pictorially correct methods for laying sheet steel roofing. Its 94 pages have a quantity of information. (10622)

• RUBBER PUTTY adheres to steel, wood, or glass, requires no mixing prior to application. Solidifies and shrinks slightly in drying, but does not become brittle. (10623)

• INSTRUMENTS—voltmeters, ammeters, and milliammeters—of pocket size have come out in a new line. Weigh only 12 ounces. (10624)

Don't Leave Dollars in the Scrap Pile

Sorting yielded this pile of Heavy Melting Steel No. 1—and a high price in the scrap materials market



If this scrap pile were sorted, its value would go up. But cost of sorting must be weighed against prices commanded by prepared scrap

Waste materials regarded as junk and sold as junk bring junk prices—to the amusement and profit of the junk dealer. If scrap is properly prepared and intelligently sold, somebody will pay good money for it

PAUL COHEN

Lassow & Cohen
New Bedford, Mass.

★

AMERICAN business is famous, or rather infamous, for the amount of waste it permits in its manufacturing processes. Although the spread of more careful management policies and the intense stimulus for lower costs have removed the edge from that criticism, experience in the scrap iron and metal industry indicates that there are still hordes of small plants (and plenty of big ones) that fail to handle their scrap problems as efficiently as they might.

Profit Possibilities

Methods of scrap prevention are no concern of this article. It is sufficient to state that scrap remains a byproduct of almost every production process and a result of the inevitable wear and tear of industry. The larger and more progressive firms have long realized the profit possibilities that lie in the proper treatment of industrial wastes, as the sometimes spectacular operations of certain huge companies illustrate. But, to the amusement and always to the profit of the junk dealers, there remain numerous organizations that regard waste materials merely as "junk," and as a natural result get paid for "junk."

Although individual conditions should indicate how elaborate need be the system for scrap disposal, plants that have not yet considered the problem will find that a little thought here will pay large dividends. As Mr. E. G. Wertheimer said recently to the National Association of Purchasing Agents, "The waste materials department frequently can make much money for a company. The field for increased revenue is often much greater in this end of the business than in purchasing."

Failure to treat scrap like any other commodity frequently leads to situations which, from a business standpoint, are downright ridiculous. A few months ago, I saw a load of scrap iron from a large metal-working plant yield several hundred pounds of brass and babbitt after a little work in the junk dealer's yard. That metal, worth as much as was paid for the entire load, could just as easily have been salvaged by the company that sold it.

Fundamentally, situations where the producer does not realize the full value of his waste materials arise when principles of preparation and merchandising, applied as a matter of course to the common products of industry, are disregarded in handling the byproducts called scrap. It should be borne in mind that scrap materials must be prepared to meet exacting specifications either by the manufacturer who produces them, the dealer, or the consumer whose raw materials they form.

Investigate the Markets

Since no universally accepted set of specifications exists in the waste materials fields, the owner of scrap should investigate his possible markets, whether these be scrap dealers or the ultimate consumers, and find out as accurately as he can what de-

gree and type of preparation will best meet their needs. It may be that for some materials only dimensional specifications are necessary. Heavy Melting Steel No. 1, for instance, may include a wide range of carbon steel, but must be in pieces not over 5 ft. long, 20 in. wide, or under ¼ in. thick. Specifications for other materials may be governed by chemical analysis.

In any case, once the needs (or, occasionally, the whims) of the market are ascertained, the next step is to check on costs and to decide whether preparation in accordance with these specifications will pay. The report of the Federal Coordinator of Transportation on the handling of scrap iron by railroads concludes that "many classes of scrap regularly sold by railroads must be further prepared either by the scrap dealers or the consumers before they are ready for use. These classes bring prices correspondingly lower than the standard grade of railroad scrap—Heavy Melting Steel No. 1, which is ready for the consumer's use. In most instances the prices received are so low as to permit the roads to spend the necessary cost of complete preparation and still realize a larger net return per ton of scrap. For example, Class 1 roads sold 642,496 net tons of 15 different classes of ferrous scrap, 500,828 net tons of which it is estimated could have been converted into heavy melting steel."

Worth $555,255 More

The report goes on to show that this material, if prepared to highest quality grades, would have increased its net realization by $555,255. These figures were for the year 1933 when scrap prices were near record lows. According to the latest figures available in the scrap iron industry, the cost of converting mixed scrap averages about $3 per ton.

When material leaving the originating point is in other than the proper shape to meet consumer needs, the dealer is forced in quoting his price to make a liberal allowance for all processing costs. Yet the point of origin is often the place where grading and preparation can be done most conveniently and cheaply, partly because of precautions that can be taken while scrap is accumulating. One of the dealer's major sources of profit is disappearing as realization of this fact among producers diminishes the tremendous tonnage of miscellaneous scrap that formerly came into his hands.

The implication that the solution to the industrial plant's scrap problem is direct dealing cannot be made, however. Preparation in accordance with consumer specifications does not guarantee either top prices or even acceptance by the consumer. The prices of waste materials are determined in the open market, a fact indicated by the extreme sensitivity of most scrap prices. Only in special cases will direct dealing yield higher profits than sale in the fiercely competitive dealer market. Nor is the consumer always willing to deal with the small producer of scrap, and most industrial plants are, as far as scrap is concerned, small. A primary function of the waste materials dealer and broker is to gather the relatively small lots of materials that reach him, and store them until he can sell in large quantities. Few manufacturing plants can sell roofing rags in trainloads or fulfill a contract with a steel mill for 10,000 tons of scrap.

Hard-to-Get Information

When a dealer purchases waste material he is vitally interested in the source, the nature, and the analysis of the scrap, and no information is more difficult for him to obtain. Consumers of scrap must know what is in their raw material, and are often willing to pay a premium for a guaranteed analysis. Even a cursory study of the metallurgical problems associated with the handling of secondary metals will indicate the reason for that situation.

Illuminating is the place of the automobile steels in the scrap iron industry. As a rule, such steels are low in sulphur and phosphorus, and are easily obtained in large quantities. They also have the apparent virtue of often containing expensive alloying elements such as nickel, chromium, and molybdenum, and valuable non-ferrous metals such as aluminum, copper, and babbit. But because the scrap iron trade is not equipped at present to sort out and handle separately the large variety of alloys used by the manufacturers, automobile scrap contains a small, variable percentage of several alloying elements which, primarily because their amount is unknown, are regarded as contaminations. That the physical properties of automobile steel scrap may be superior to those of heavy melting steel is immaterial; these properties are variable and unpredictable.

Labor and Gas

The preparation of scrap iron, like that of most other scrap materials, requires relatively little apparatus or skilled labor. Ordinarily, a shear capable of cutting two-inch rounds, an oxy-acetylene cutting torch, a scale, and a truck are all the equipment necessary; in fact, some dealers are not so well equipped. Labor and gas are the two largest items.

Scrap materials originate from production, maintenance, and dismantling operations. The main precaution to be taken with scrap from the production department is to prevent contamination. Brass chips, dumped into any boxes that may be handy, and mixed with iron bolts, oily waste, and floor sweepings, can hardly be expected to get top prices. It is often worth while to centrifuge oily chips and turnings in order to reclaim the cutting oil. Loose material that is difficult to handle, such as stampings, skeletons, paper, and textile wastes, should be baled where quantity permits.

Although a full discussion of textile wastes, with their bewildering variety of forms, is difficult, the practice common in the needle trades may be worth mentioning. The method there is to sort the clippings on the cutting tables, separating pieces of remnant and wiping-rag size from smaller pieces, white from colored rags, and, of course, one kind of material from another. The graded materials are then transported in box trucks to the bins or other receptacles in which the rags are stored. Greater pains may be taken with an expensive material like wool or silk than with a relatively cheap product like cotton.

Scrap from maintenance, largely because of

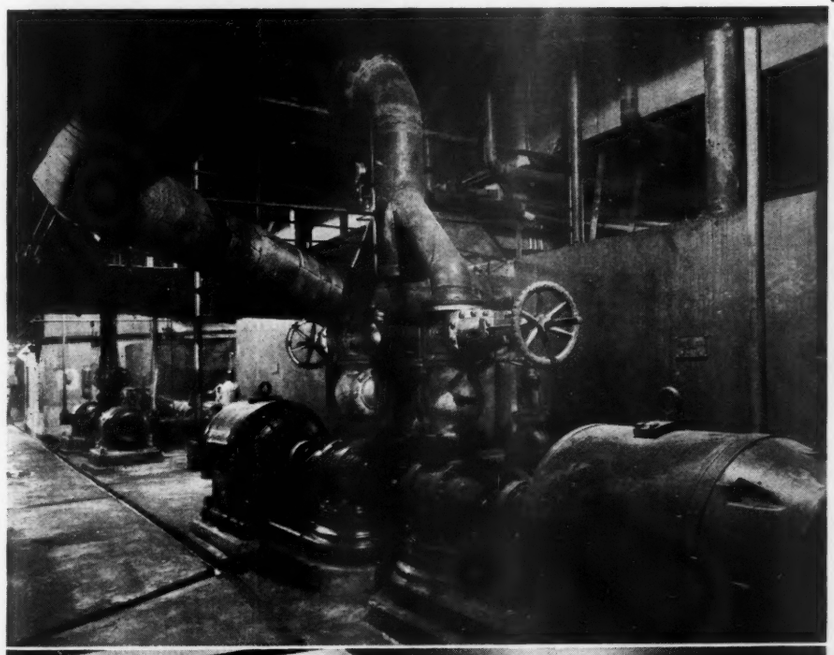
Pipes should not be cut up—they can be salvaged

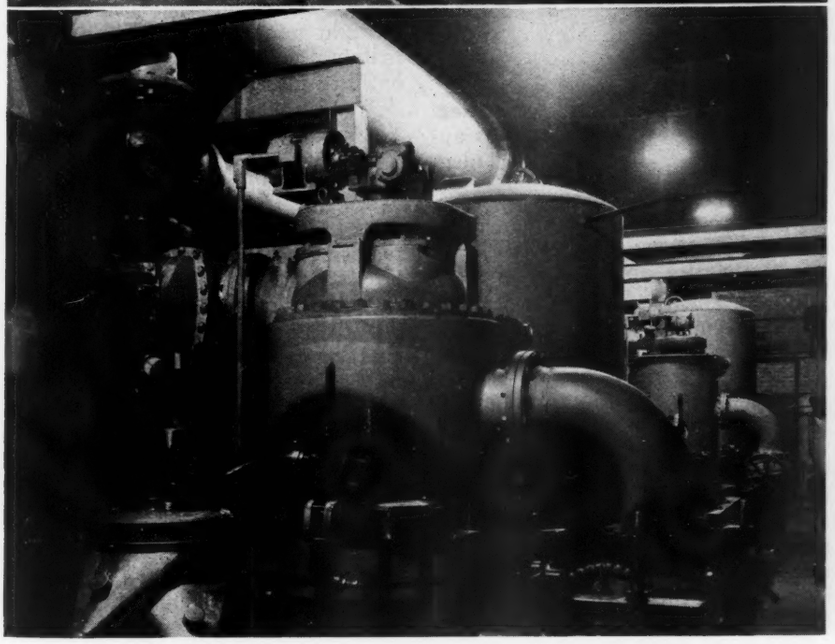
(Continued on page 86)

Thousands of Bearings to Lubricate

W. A. JAMES
Chief Engineer, Lackawanna Plant
Bethlehem Steel Company, Lackawanna, N. Y.

Seven automatic pressure systems in Bethlehem's new hot and cold strip mills insure grease and oil in the right amounts at the right intervals, minimum labor costs, trouble-free operation





Lubricating oil for the hot mill is stored in 10,000-gal. tanks located in an oil cellar below the mill. (Below) Part of the pressure-lubrication equipment for the hot mill

PROPER lubrication is one of the most important factors in the design and operation of steel mill equipment. Therefore, when the new hot and cold strip mills were being designed for the Lackawanna Plant, the matter of lubrication received most careful consideration. Study of the problems led to the conclusion that the best results could be obtained by using four complete centralized pressure systems in the hot strip mill, and three similar systems in the cold strip mill.

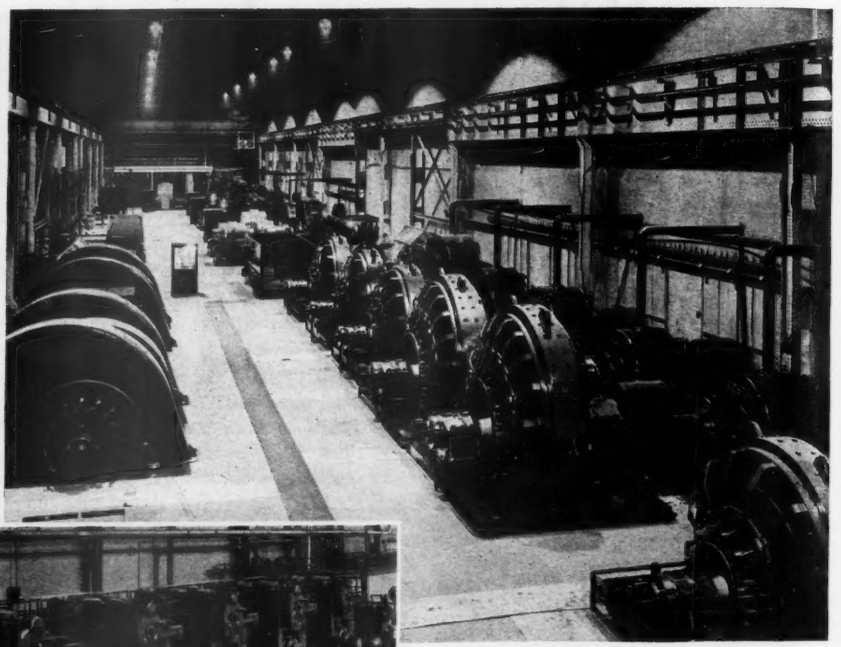
The 79-in. hot strip mill consists of a roughing and a finishing train. In the roughing train is a two-high scale breaker, a four-high spreading stand, and three four-high universal stands with vertical rolls on the entering side. Between scale breaker and spreading stand is a turntable for turning the slabs 90 deg., and a pusher. A second turntable is located between the spreader and the following stand for returning the spread slab to its original direction, and a squeezer for squaring up the edges.

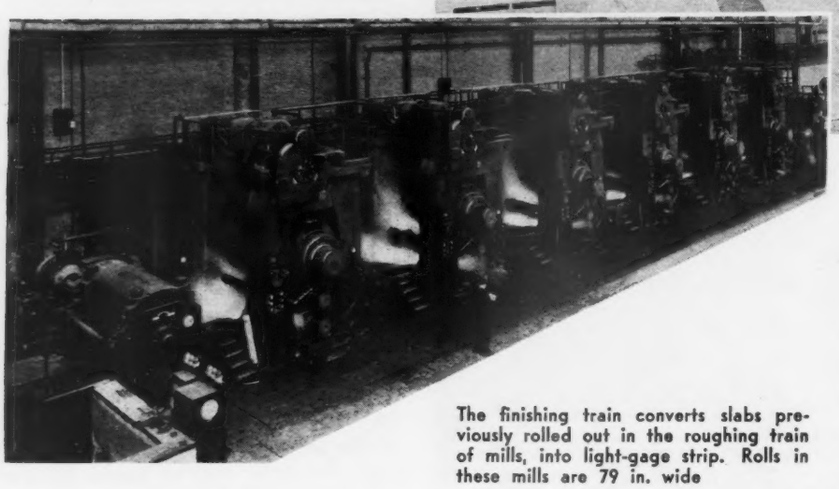
A two-high scale breaker and six stands of four-high rolls comprise the finishing train. After the last stand of the finishing train there is a rotary flying shear. At the lower end of the first transfer table there are two hot coilers, with a cooling conveyor for delivering the coils to storage, from which they are delivered to the cold strip mill.

Comprising the cold strip mill there are a three-stand, four-high,

75-in. tandem cold strip mill followed by a reel; a three-stand, four-high, 54-in. tandem cold strip mill, with a reel; one single-stand, four-high, 75-in. tempering mill equipped with a reel; one single-stand, four-high, 93-in. tempering mill; and one single-stand, 75-in. tempering mill without reels, for rolling short sheet lengths. In addition, there is a single-stand, two-high, 54-in. skin pass mill, equipped with reel, for rolling coils.

Of the seven pressure-lubrication systems referred to above, the four systems for the hot strip mill were grouped together in an oil cellar under the mill floor, between the last roughing stand and the finishing mill scale breaker.





The finishing train converts slabs previously rolled out in the roughing train of mills, into light-gage strip. Rolls in these mills are 79 in. wide

Twelve large motors with an aggregate rating of 36,000 hp., and 1,800 small motors are required to operate the ten mill stands and two scale breakers in the hot mill. Bearings of the large motors are lubricated by one of the centralized pressure systems

The three lubrication systems for the cold strip mill were likewise grouped in a common oil cellar, located between the three-stand, four-high, 54-in. tandem cold strip mill and the first single-stand, four-high, 75-in. tempering mill.

Functions of these lubrication systems are:

System No. 1, Hot Mill. Designed to lubricate meshing points and bearings of reduction gear sets of all roughing and finishing stands. The lubricant employed is a straight mineral oil having: Viscosity at 100 deg. F., approximately 1,500 S.S.U.; viscosity at 210 deg. F., approximately 115 S.S.U.; approximate specific gravity, 26.6 deg. Be.

System No. 2, Hot Mill. Lubricates meshing points and bearings of pinion stands of all roughing and finishing stands, and top bearings of vertical rolls. Lubricant is a straight mineral oil having: Viscosity at 100 deg. F., approximately 2,300 S.S.U.; viscosity at 210 deg. F., approximately 150 S.S.U.; approximate specific gravity, 25.7 deg. Be.

System No. 3, Hot Mill. Lubricates Mesta-type, back-up-roll bearings of all four-high mill stands of the roughing and finishing trains. The lubricant employed in this system is a straight mineral oil having approximately the same characteristics as outlined under No. 2 system.

System No. 4, Hot Mill. Lubricates bearings of all main motors of the roughing and finishing trains, as well as the bearings of two 1,500-kw. m.-g. sets of the roughing mill and two 6,000-k.w. m.-g. sets of the finishing mill, provision being made for the addition of one 4,000-kw. m-g. set in the roughing mill. The lubricant employed is a straight mineral oil having: Viscosity at 100 deg. F., approximately 320 S.S.U.; viscosity at 210 deg. F., approximately 50 S.S.U.; approximate specific gravity, 24.8 deg. Be.

System No. 5, Cold Mill. Lubricates gear and pinion meshing points and bearings of combination reduction gear drives and pinion stands, gear meshing points and bearings of straight reduction gear drives of all main drives and reel drives of the 54-in. and 75-in. tandem cold mills, of the 90-in. and 75-in. single-stand tempering mills, and of the 54-in. skin pass mill. Lubricant is a straight mineral oil having approximately the same characteristics as outlined under No. 1 system.

System No. 6, Cold Mill. Lubricates all Mesta-type, back-up-roll bearings of three stands each of the 75-in. and 54-in. tandem cold mills, of the 75-in. and 90-in. single-stand tempering mills, and the same type bearings of the 54-in. skin pass mill. The lubricant is a straight mineral oil having approximately the same characteristics as the lubricant used in the No. 2 system.

System No. 7, Cold Mill. For bearings of all main drive and reel drive motors of the 75-in. and 54-in. tandem cold strip mills, the 75-in. and 90-in. single-stand tempering mills, and the 54-in. skin pass mill, as well as the bearings of the 6,000-, the 2,500-, and the 1,300-kw. m.-g. sets.

(Continued on page 88)

Time and Circuit Control

H. K. NOCK
Meter Division, General Electric Company
Schenectady, N. Y.

Time switches assure starting and stopping of equipment exactly when desired, eliminate penalties imposed by forgetfulness or neglect

•

TIME is a factor of major importance in most industries. Factories start and stop, and working shifts change, at definite times of day. Elapsed time is a measure of dollars appreciation in the value of raw materials, and in dollars for the workman's pay envelope.

When we note the time from a watch or clock the fact that it is now 10:31 a.m. or 3 o'clock in the afternoon is important only because so many hours or minutes have passed since such and such an event took place, or so many hours or minutes have yet to pass before this or that must be done. Thus does time regulate our behavior; therefore, instruments for its measurement and control become indispensable in many manufacturing operations.

Automobile tire manufacture is an example. During the process of converting the raw materials into the finished product an incredibly short space of time is carefully subdivided among successive operations, each of which is held rigorously to no more and no less than its proper share of the whole. Any deviation from these limits is likely to affect seriously the quality and life of the tire.

This example is typical of industry's use of time control in the fabrication of many products. As the smaller increments of time assume greater significance, so do the means of controlling them become more important. Therefore, it comes about that time control tends to serve manufacturing processes best when it is wholly automatic.

Since electricity is almost universally used for driving industry's machinery, it follows that a device which correlates time with the opening or closing of electric circuits is an important means of control. Time switches perform that function.

The nature of the circuits to be opened or closed varies, of course, with the type of apparatus to be controlled. Proper contacts or circuit layouts can readily be developed when more than the simple make-and-break contacts, normally a part of most time switches, are necessary.

Naturally the time factor in this partnership of time and electric circuit control varies. To date, these variations may be classified under four general headings: (1) Time of day; (2) repetition of a cycle; (3) elapsed time; and (4) as a corrollary to these three, the simple recording or indicating of total elapsed time.

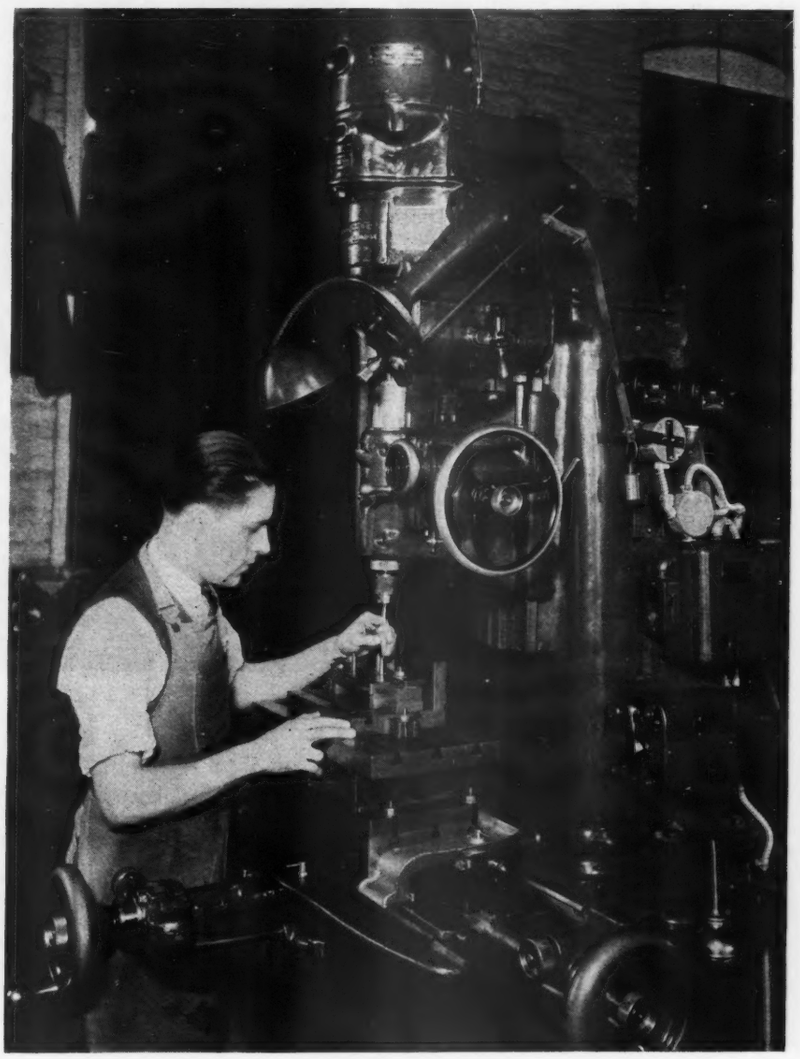
Time-of-Day Operation

A time switch controlling an electric circuit on a time-of-day basis obviously opens and closes contacts at predetermined times of day. Such schedules are the most commonly found. They are occasionally varied so that circuits may be controlled "astronomically"—that is, with respect to the time of sunrise and sunset.

Often time switches of this type are also equipped with means of preventing their operation on Sundays and holidays.

Examples of the use of this form of time control abound in industry. For instance, it is common practice

Time meters, at the right, check up on the hours' usage of a jig-boring machine



to preheat lead pots used in the preparation of electrotypes. Automatically turning on the current to such heaters in advance assures the metal's readiness for use when the working shift begins.

Similarly, electrically heated furnaces used in various manufacturing processes have current automatically turned on early in the morning, so that they will be ready for use when the operators start work.

Again it may be necessary to operate a tumbling barrel for some time after the plant has shut down for the day. Or possibly a mixing or an agitating process must be continued for some definite time after the normal working hours.

In all these instances the time switch keeps the supply of electric current on until the predetermined time is reached; then it is automatically shut off. The advantages of such an arrangement, and the savings that it can make, are obvious.

These applications are typical of the many and varied useful control functions which can be assigned to a simple, time-of-day time switch to save industry money.

Paint, Tires, and Bread

The second form of the partnership of time and electric circuit control is a time switch that functions without regard to the time of day. For this purpose the time switch is arranged to make or break a circuit according to a prearranged sequence. It, in turn, is started and stopped usually by a operator, or by a time-of-day time switch.

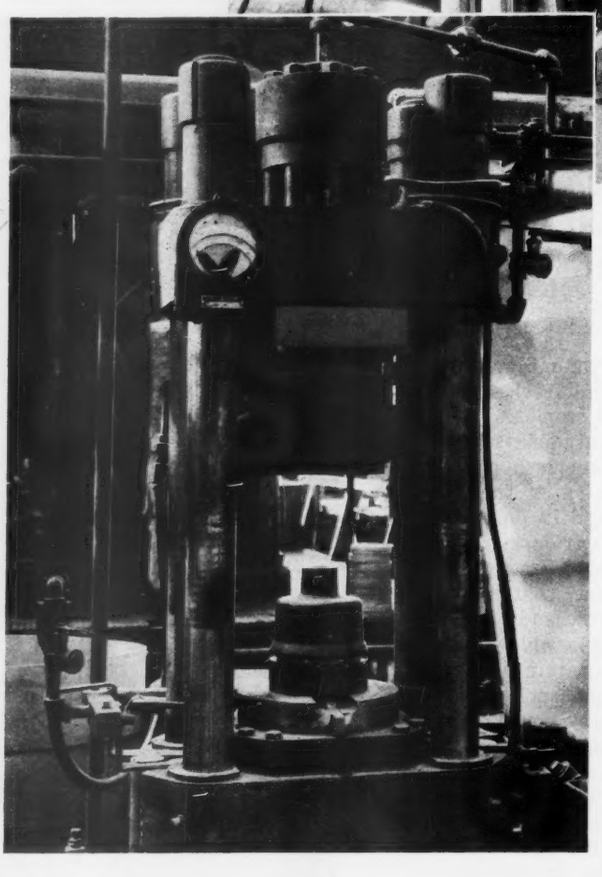
In this classification of time switch applications a circuit is closed possibly for a definite number of minutes out of every hour, or during some shorter or longer interval. This percentage of the total cycle that is assigned to the closed circuit usually is simply and conveniently adjustable. Different combinations of circuit arrangements, each of which gets a predetermined share of the total time period comprising the cycle to be repeated, are also possible. There are many uses to which manufacturing industry puts time switches of this type.

One simple application of such a time switch is in applying lubrication to large apparatus for a definite number of seconds out of every hour. With apparatus for filtering air, screen cleaning is similarly controlled.

In the automatic mixing of paints or similar compounds certain agitating processes must at specific times be carried on for a stipulated period, which is a fixed part of a repeating cycle. The cyclically repeating time switch provides the necessary control.

With the elapsed-time switch, contacts are opened to terminate a process after a definite elapsed time, or perhaps closed to initiate a process so many seconds, minutes, or hours after some other process has been initiated or concluded.

Controlled by a time switch, this elevator-type electric annealing furnace is always hot when needed, doesn't waste power when heat is not required



When the curing period is over, the time switch warns the operator of a plastics molding machine, by light or bell

Again, perhaps this form of time switch contains within itself a group of contacts for automatically starting or stopping a sequence of several processes, each of which is timed for initiation or conclusion at a stipulated time with respect to the others.

Time switches of this character find application in the molding of automobile tires and tubes, as mentioned earlier. They also find application in controlling the mixing time of bread dough and, in direct association with this, the length of time the bread remains in the oven. Typical of such applications is the process of sugar refining, in which a number of processes must have definite time relations to one another. The time switch does the job simply and conveniently, without attend- and conveniently, without the attendance of an operator.

A simple use of this partnership of time and the control of electric

Induction Motor Maintenance

5. ROTORS

LIONEL A. HUNT
Service Engineer
Bepco Canada Limited, Toronto, Canada

ROTORS of slipring motors have so many features in common with stators that the points covered in the article on stator maintenance in the July issue may well be applied to wound rotors. In addition to the details discussed previously, rotors have some peculiarities of their own, due to the fact that they revolve.

Wound rotors usually have a three-phase winding regardless of the number of phases in the stator, and a rather common trouble is single-phase operation. This condition is usually caused by the breaking off of a lead or stud behind the slip-rings. It is characterized by the motor slowing down and growling, and showing an evident lack of power. If such symptoms develop, lift the brushes from the rings and test for circuit across the rings and across the rotor lines. The rotor controller should be kept in the running position in order to short-circuit these lines for the test.

If the open is in the control circuit, the rings can be short-circuited and the motor operated as an induction motor with short-circuited secondary, provided it is not too large to start. On the other hand, if the rotor is open-circuited, there is nothing that can be done except to repair the defect.

One ground in a rotor usually is not serious, although, if the control or grids are also grounded, circulating currents may pass through and result in pitting of the shaft.

Take Care When Cutting Out Coils

Two grounds are, of course, equivalent to a short circuit; they may have the effect of unbalancing the rotor electrically, and cause excessive vibration of the motor. Abnormal wear of sliprings can be caused by electrical unbalance.

When grounds or shorts exist it may be necessary to cut one or two coils in order to maintain service, although proper repairs should be made as soon as possible. Cutting out coils in rotors is more tricky than in stators, since most rotors are wave wound.

The usual procedure is to pass a conductor through the spider and substitute it for the coil that is being cut out. This temporary conductor should be of strap copper equivalent in size to the rotor conductors. It must be well insulated and braced. See Figure 1. If the short circuit is between the bottom and top halves of the winding it may be necessary to pass two or more temporary conductors through the spider and cut the coils out. These coils should be replaced, of course, at the first opportunity.

Banding and Balancing

To make sure that no shorts exist in the rotor, lift the brushes from the rings and energize the stator. Under these conditions the rotor should show practically no tendency to rotate. The voltages across the rings should be equal. If they are unequal, turn the rotor slightly to make sure that the inequality is not due to the relative positions of the rotor and stator phases. Also, the stator should take only about 35 per cent of full-load current.

Whenever it becomes necessary to remove the bands of the rotor, they can be unwound by unsoldering the clips and pulling on the wire sufficiently hard to break the solder bond. If it is necessary to cut the band, do it with a hacksaw, not a chisel. When rebanding make sure that the bands are tight and of sufficient strength. Figure 2 shows what may happen if the bands are too weak to resist the stresses put on them. After banding or doing any work on a rotor, it should be balanced. Usually only static balance can be obtained. For this purpose the rotor journals are placed on two planed, knife-edge rails that are accurately level while the rotor weight is on them. The rotor will turn until the heavy side is at the bottom, in which position the rotor will come to rest. Now put solder on the bands at the top until the rotor will remain in any position to which it is rolled.

If a rotor is not properly balanced,

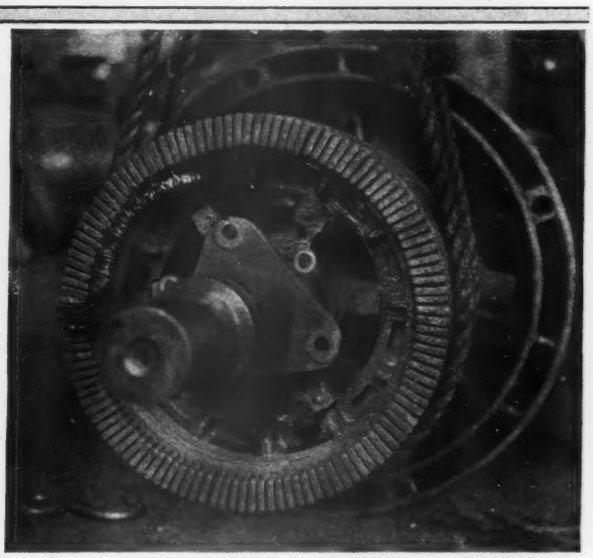


FIGURE 1. When coils are cut out of a wound rotor, strap copper conductors of equivalent cross-section are threaded through the spider. They must be well insulated and braced. On this rotor the lower lead has been burned off close to the ring position

excessive wear of brushes and rings will result.

Wound rotors should be kept clean, be periodically painted, and be carefully handled.

Squirrel-cage secondaries are more rugged and require less maintenance than wound rotors, but they too should be periodically inspected. The most usual form of trouble is poor contact between the bars and end rings, or broken bars. Evidence of these faults appears in the slowing down of the motor under load, and reduced starting torque. To locate such defects, run the motor for a moment when it is cold; then stop it and feel around the rotor for hot places. If any are found, it indicates that the hot bars are not making good contact with the end rings. A brake test will usually reveal a defective rotor, but close examination is the most satisfactory way of detecting defects.

After removing the rotor, inspect the bars for breaks, which are usually found just at the point where they leave laminations, or at the ring. If the bars appear to be unbroken, inspect the rotor for discolored bars, which are evidence of heating. Insert a screwdriver between the bars and see whether prying produces any movement. Whenever an inspection reveals loose bars, the rotor should be brazed or welded.

On high-resistance rotors, such as some elevator motors have, use hard solder or silver solder. It is important to clean the rings and bar ends thoroughly before soldering or brazing. If a rotor that was previously soldered is to be brazed, the solder must be melted and cleaned off before applying brass; otherwise a porous alloy of relatively high resistance will be formed. Brazing should be done only by experienced workmen because it is necessary that a good electrical as well as mechanical bond be made.

Replace Broken Bars

The secret of successful and even brazing lies in the application of sufficient heat. Rotor rings should be preheated with a gasoline or gas-air torch before applying the oxy-acetylene flame; then the preheating flame should be kept on the work just below the acetylene flame so that the heated part comes up to be brazed. Use Tobin bronze rod and a good brazing flux and do not add any more spelter than is necessary to flow between the bar and ring and form a nice fillet.

Keep in mind the fact that the operating characteristics of the motor depend on the resistance of the rotor end rings, and that if too much brass is added it will alter this resistance. After brazing, it is necessary to turn some metal off the sides of the rings in order to bring the rotor resistance back to normal.

If a considerable number off bars are broken, it may be necessary to rebuild the entire squirrel-cage winding. In this event, the procedure is to saw off the end rings, as in Figure 3, drive out all the bars, and replace them with new copper. If brass end rings were previously used, it is usually more satisfactory to replace them with copper rings having one-fourth the cross-sectional area, assuming the conductivity of the copper to be four times that of the brass.

(Continued on page 100)

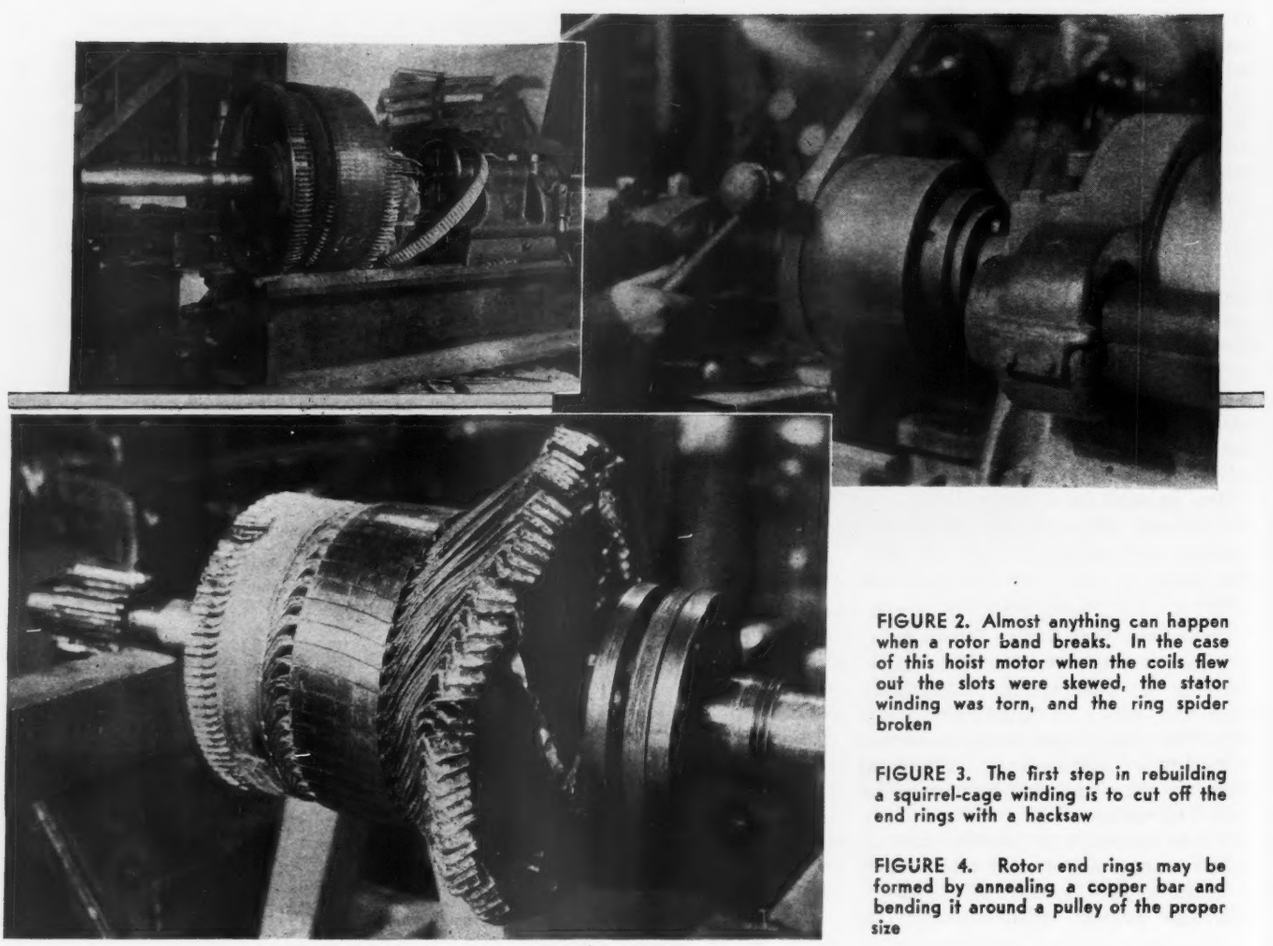
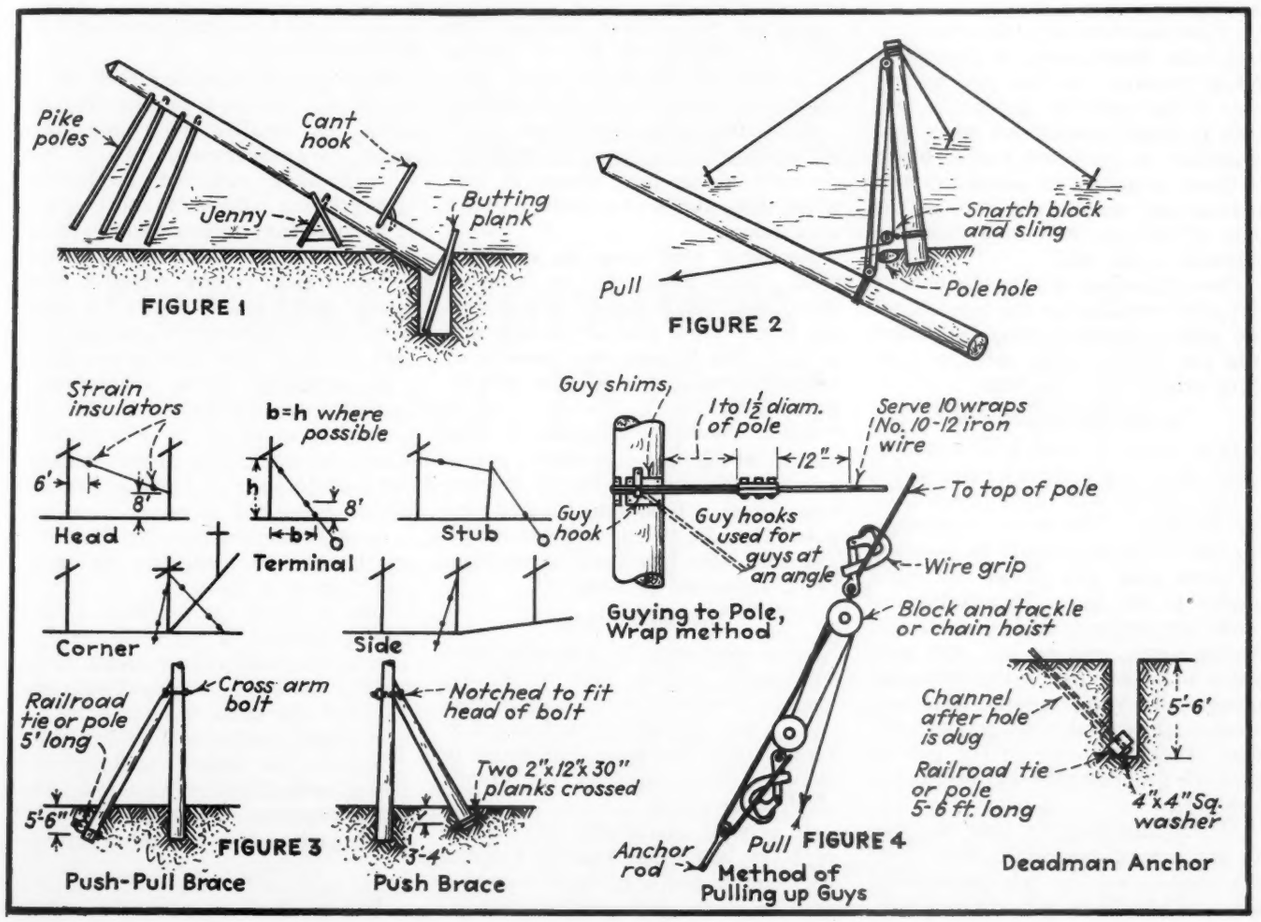


FIGURE 2. Almost anything can happen when a rotor band breaks. In the case of this hoist motor when the coils flew out the slots were skewed, the stator winding was torn, and the ring spider broken

FIGURE 3. The first step in rebuilding a squirrel-cage winding is to cut off the end rings with a hacksaw

FIGURE 4. Rotor end rings may be formed by annealing a copper bar and bending it around a pulley of the proper size

Overhead Pole Lines



WHEN digging pole holes allow enough room for the butt to slide in easily, and facilitate tamping of the earth backfill for the entire depth of the pole.

Use a long-handled shovel to break away the earth. A spoon, like a shovel with its blade at an angle, is used to pick up the earth broken away by the shovel. When the earth is too hard to be broken away easily by the shovel use a digging bar, which consists of a flat blade attached to an iron rod. Some bars have a tamping head on one end.

If a pole is to be set in soft or sandy earth, it may be necessary to sink a cylinder such as a headless barrel or a piece of old smokestack, to prevent the earth from caving in. The cylinder is pushed down as the earth is removed from the inside, and is allowed to remain.

The following table shows the depths recommended in Handbook No. 3, fourth edition, National Electrical Safety Codes, for pole holes under straight-line conditions in firm soil or rock:

RECOMMENDED DEPTH FOR SETTING POLES

Height of Pole, Feet	*In Soil, Feet*	*In Rock, Feet*
20	5.0	3.0
25	5.0	3.5
30	5.5	3.5
35	6.0	4.0
40	6.0	4.0
45	6.5	4.5
50	7.0	4.5
55	7.0	5.0
60	7.5	5.0
65	8.0	6.0
70	8.0	6.0
75	8.5	6.0
80	9.0	6.5

These values are usually increased by 6 in. for corners, angles, or heavy dead-ends.

Procedure in erecting poles by the pike-pole method is shown in Figure 1. To raise a 30-ft. pole will require at least six men; four or five with pike poles, one at the jenny and one at the butt of the pole, with one or two cant hooks to prevent the pole from turning. The wood plank prevents the pole from digging into the side of the hole. More men will be needed for longer poles.

Use of a gin pole, Figure 2, is less laborious. It should be at least one-half as long as the pole to be erected, and placed so that its top is directly over the pole hole. Guy the gin pole to points on nearby buildings, trees, or poles. If this cannot be done drive stakes into the ground.

After guy ropes and block and tackle have been attached to the gin

Overhead Pole Lines

(Continued from preceding page)

pole, raise it by means of pike poles. Where possible set the gin pole at least a foot into the ground to prevent it from kicking out when pull is applied to the lower snatch block. If there is any doubt about the butt kicking out, place a guy rope at the butt of the gin pole in a direction opposite to the pull.

Place the sling so that the butt of the pole overbalances the top. After the pole is raised it may be guided into the hole by pike poles or rope lines attached to the butt.

Setting and Equipping Poles

If a crane or derrick is available poles can be erected much more easily.

Line up the pole after it has been put in place. The gains or recesses for the crossarms should be reversed on each pole and placed at right angles to the line. Exceptions are made for corners, angles, crossings, double arms, and so on. On long spans the pole next to the long-span pole should face opposite the long span. In general, always place the face (the gain side) of the pole so that the greatest pull will be against the pole.

Use a cant hook to turn the pole to its proper position. Pike poles are used to set the pole perpendicular, and should be left in place until the hole is filled.

Backfill should be well tamped, with, if possible, small stones or gravel thrown in. Wetting the earth helps settle it around the stones.

Wood or steel crossarms may be used. The top of wooden crossarms should be rounded slightly to shed water. For average requirements, arms having a cross-section of 3½x4½ in. are suitable. Vertically, crossarms are usually spaced on 24-in. centers.

Steel crossarms are used where there are heavy feeders or stresses.

The distance between crossarm center pins is usually 30 in. to provide safe climbing space. Distance between pins usually is 12 in. for an eight-pin arm, and 14½ in. for six- and four-pin arms. Spacing of conductors will vary with the voltage and span length. For example conductors of a 2,300-volt line would be spaced on 12- to 18-in. centers, and those of a 6,000-volt line on 18- to 24-in. centers, depending upon span length and local weather conditions.

Use double crossarms where a single arm will not provide sufficient strength as on long spans, at terminal ends, and where conductors are very heavy.

Insulator pins may be wood or steel. Wood pins, made in standard sizes, are usually used for low-voltage lines. Steel pins are used where a longer pin is necessary because of higher voltages. Steel pins provide greater rigidity.

Poles should be stepped if they are to be climbed frequently, especially if they carry floodlights or junction boxes. Common spacing for pole steps is 16 in. between steps. The first step should not be less than 6½ ft. above the ground.

Use Plenty of Guys

It is necessary to guy the poles sufficiently before the wires are strung, because it is much more difficult to pull the pole into line afterwards. It is far more economical to have a line somewhat over-guyed than under-guyed.

In general, install guy wires wherever the line wires tend to pull the pole out of position, as at terminal ends, corners, and angles. Always place guys so that they balance the pull of the line wires. Figure 3 shows the principal types of guys.

Guy wires are made in various sizes from ⅛- to ⅝-in. diameter. The ¼-in. and ⅜-in. sizes are usually used for all-purpose guying. The method of pulling up guy wires is shown in Figure 4.

In all guy wires put at least one strain insulator, preferably two, not less than 8 ft. from the ground and 6 ft. from the pole, or the nearest conductor.

In all pole line work it is necessary to maintain certain clearances. Systems operating at 750 to 15,000 volts require a minimum vertical clearance of 28 ft. over railroad tracks, 20 ft. over streets and roadways, and 15 ft. over pedestrian walks. The horizontal minimum clearance is 12 ft. for main railroad tracks, and 7 ft. for railroad sidings. Poles should be set not less than 6 ft. from buildings.

As a rule wire smaller than No. 6 should not be used for distribution work. A smaller wire may have ample current-carrying capacity but it will have sufficient mechanical strength for only very short spans. It is customary to use weatherproof, double- or triple-braid-covered wire.

Soft-drawn copper wire is commonly used around plants for ordinary distribution work because it is easy to handle and strong enough.

In stringing wires, several may be pulled over the crossarms through a number of spans by a rope line. When in place, the proper tension can be obtained by a block and tackle, before tying the wire.

Another method is to lay the wires on the ground alongside the poles, and then hoist them up.

Use a No. 6 tie for Nos. 4 to 6 line conductors; a No. 4 tie for Nos. 1 to 4 line conductors; and a No. 2 tie for No. 0 and larger conductors. Wire of the same kind and insulation as the conductor should be used.

Sag in the wires should be adjusted so that the proper safe tension is not exceeded. It should not be so great as to cause undue swinging.

Two Choices in Insulators

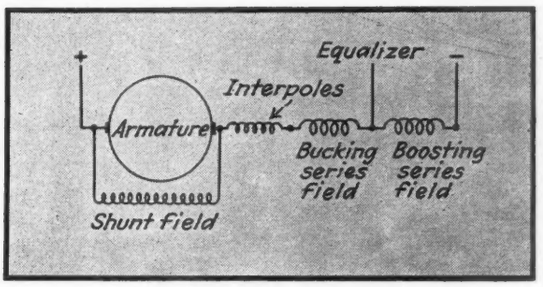
Either glass or porcelain insulators are used on distribution circuits. A deep-groove, double-petticoat insulator is usually used on low-voltage circuits. These insulators are commonly made of glass and are suitable for lines up to 2,200 volts. The groove can accommodate a 4/0 wire held in place by a tie.

For higher voltages porcelain is usually employed.

Pin insulators with a groove on top are used for carrying heavy feeders. Most high-voltage pin insulators have both top and side grooves. The top groove is used in straight runs and the side groove at angles. Always place the conductor on the insulator in such position that the strain is carried by the insulator, not by the tie wire.

Pin insulators are made for use up to about 50,000 volts; for higher voltages suspension insulators are more economical.

Prepared by P. LINDHOLM, Newark, N. J.



Interpole compounding can be overcome by providing the generator with a bucking and a boosting series field

Parallel Operation of D.C. Generators

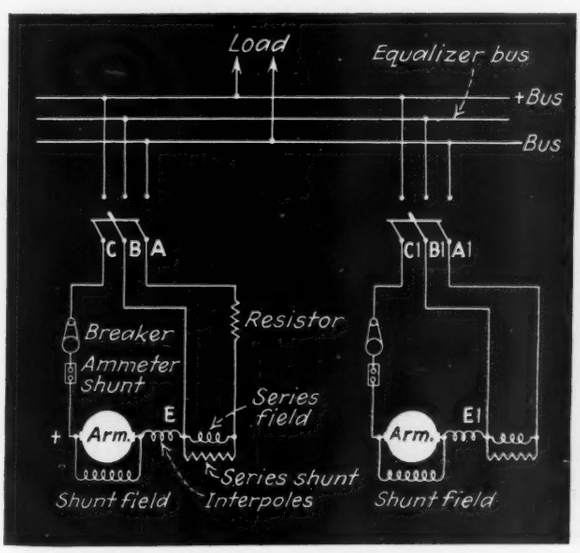
J. DIXON
Construction Engineer
Crocker-Wheeler Electric Manufacturing Company
Ampere, N. J.

ADDITION of a new d.c. generating unit to an existing plant is sometimes accompanied by difficulty in getting it to share the load properly with the old units. In such instances one of the first steps in attacking the problem is to make sure that the principles underlying it are understood.

Good operation of compound generators in parallel may be considered to be achieved when two or more units supplying the same load share the load according to their capacities within a margin of, say, 5 per cent of exact proportional division.

When the generators and prime movers are of the same general kind, even though they are of different size, satisfactory parallel operation can usually be obtained without difficulty. If there is any trouble it is likely to be found in the resistance of the mains to the switchboard, or in the speed governors of the engines.

In cases where widely different units are coupled—for example, a slow-speed engine unit and a high-speed turbo-generator of modern design—successful operation may be difficult to achieve. Still more likely to give trouble is the operation of a slow-speed unit in parallel with a high-speed generator driven at constant speed by a synchronous motor.



For satisfactory parallel operation of compound d.c. generators: (1) Terminal voltages, *A-C* and *A1-C1*, must be equal at all loads. (2) Voltage drop at full load, *A-B* and *A1-B1*, in series circuits must be equal. A resistor may be needed in the series main. (3) Voltage regulation inside the equalizer, *B-C* and *B1-C1*, must be drooping with increasing load. (4) Equalizer resistance, *E-E1*, must be low

These Conditions Must Be Met

There are five major requirements for good performance of two or more generators in parallel:

1. Voltages at the board must be equal, for all loads.
2. Voltage regulation, or variation from no load to full load, must be the same.
3. Voltage drops at full load from equalizer terminal through the series fields and series mains to the board, must be equal.
4. Voltage regulation inside the equalizer, from equalizer terminal to armature terminal, must be slightly drooping or decreasing as the load increases. A desirable amount is 2 per cent.
5. The equalizer resistance must be low.

The first two of these requirements are met by proper adjustment of the shunt field current by a rheostat; of the series field current, by shunting; and of engine speed, by correct setting of the governor.

Voltage drop to the board is that caused by the current from the armature flowing through the series winding and its shunt, if any is used, and through the series main to the board. A high-speed machine usu-

(Continued on page 102)

Operating Shorts

Jack Facilitates Wedging of Stator Coils

C. E. ROGERS, *East Angus, Quebec*

When winding a stator or armature with form-wound coils it is often necessary to drive the coils into the slots with a hammer, in order to get the wedges in. Aside from the fact that this procedure takes considerable time, serious damage is often done to coils that are driven in in this manner.

To solve this problem I devised what we call a winding jack. As will be seen, it can easily be made, and may save its moderate cost on one winding job.

In operation the jack is placed inside the stator with the curved end placed at a right angle to the slots. The straight piece, which carries the threaded rod, is placed on top of the coil to be forced into place. Tightening the nut forces the coil into the slot, so that the coil wedges can easily be inserted.

Although this jack was devised primarily for winding a.c. stators, it can be used just as well on armatures. Recently a d.c. armature was rewound in which the coils were unusually tight. To facilitate installation of the coils, a frame made of 1½-in. angle iron was fastened to the horses holding the armature, and the jack was used as shown to force the coils into the slots. It worked like a charm. The time saved offset the work of rigging up the frame ten times over.

Mr. Rogers's contribution has been awarded the $10 *payment offered by the editors for the best Operating Short submitted during the past month.*

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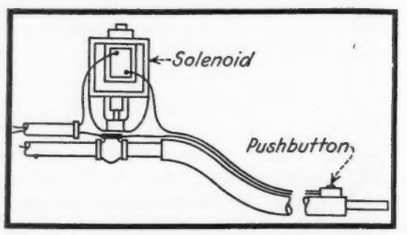
Solenoid Valve Controls Flow of Lubricant

C. C. HERMANN, *Waterloo, Ia.*

Frequently need arises for a dependable means of controlling the flow of a liquid at some remote point, or in some process where operation of an ordinary valve presents difficulty. Again, it may be that the time required to open and close an ordinary valve is out of all proportion to the time that the liquid flows. In many instances of this kind a solenoid-operated valve may be used to good advantage.

One such application was made in connection with the introduction of lubricant into gear housings. A spring-loaded valve operated by a solenoid was put in the pipe line containing the lubricant under pressure. A motor-operated valve could have been used, but the initial cost was considered to be too high, in view of the large number of outlets required. The solenoid chosen was designed to be used on a 110-volt, a.c. circuit. It has a pull of 40 lb., continuous duty, and a lift of 2 in., which is ample for the 1¼-in. pipe line.

The delivery end of the valve carries a pipe nipple to which was attached a length of hose with a short piece of pipe that is inserted into the filling hole of the housings. The pushbutton for operating the valve was fastened near the end of the hose, for convenience.



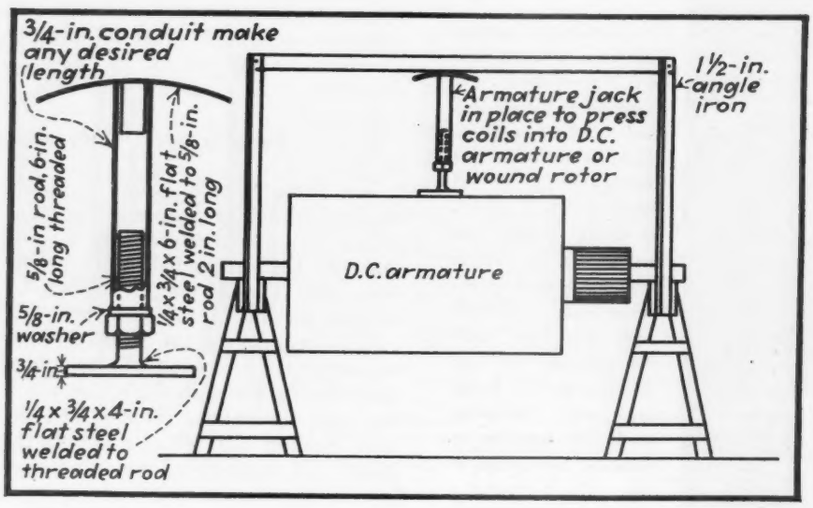
When selecting solenoids it is important to choose one that is neither too large nor too small. If the solenoid is too large for the requirements there will be a tendency for the plunger to pull in with considerable speed, resulting in a hammer blow. Where quiet operation is essential the solenoid should be selected with particular care, as to size, and provided with a case that will permit it to be operated in oil.

•

To Keep Fire Extinguishers from Freezing

C. H. SMITH, *Superintendent*
The Presstite Engineering Company
St. Louis

To protect a 2½-gal. fire extinguisher from freezing slip a 2-ft. length of asbestos pipe covering 8 in. in diameter over it, starting at the bottom. Insert a plug, cut from a 1-in. board to an 8-in. tapered circle, into the bottom of the jacket. On the inside face of the plug


3/4-in. conduit make any desired length
5/8-in rod, 6-in. long threaded
1/4 x 3/4 x 6-in. flat steel welded to 5/8-in. rod 2 in. long
5/8-in. washer
3/4-in.
1/4 x 3/4 x 4-in. flat steel welded to threaded rod
Armature jack in place to press coils into D.C. armature or wound rotor
1½-in. angle iron
D.C. armature

mount a porcelain socket with a 7-watt "night" lamp. This will maintain a 20-deg. thermal head over the outside temperature, ample to prevent freezing in most locations. A larger lamp can be used if a higher thermal head is needed.

For those who want to give the extinguisher a neat appearance (as we did), cover the entire jacket with heavy chip board glued into place, apply aluminum paint, and stencil "For fire—pull jacket down" with the arrow pointing downward. Also, install a bull's-eye through the jacket so that you can see whether the lamp is burning.

Air conditioning in a seed company's storeroom keeps seeds in a higher state of germination than previously. Not only are thousands of dollars in cold storage fees saved, but the exact temperature and humidity desired can be maintained.

Better Light Cuts Rejections 50 Per Cent

W. WENDELKIN, *Works Maintenance Engineering, Westinghouse Electric & Manufacturing Company East Pittsburgh, Pa.*

Changes recently made in our wire covering department have again demonstrated the vital importance of good lighting on the quality and amount of production.

This department was formerly located in an old building with erratically spaced "drop cord" lighting, varying in intensity from practically zero in spots to not more than 12 foot-candles at the best location. In this department round wire, sizes No. 12 to No. 36, is covered with cotton, and wire sizes No. 16 to No. 36 with silk, or with paper 0.001 in. thick. Odd sizes of wire and a variety of shapes are also covered, although in smaller amounts.

The department now occupies approximately 9,000 sq.ft. of floor space. Lighting is provided by 80 500-watt Glassteel diffusing units mounted 12 ft. from the floor and spaced on 10-ft. centers, which give an even distribution of light over the entire area at an intensity of 30 foot-candles.

The circuits are arranged so that the lights can be turned off in rows parallel with the windows when the daylight intensity is so high that the lights along the window area are not required.

To obtain high light-reflection value, the walls and ceiling were painted white, and to insure cleanliness, air cleaning equipment was installed. One of these units can be seen on the wall at the extreme left. The cotton storeroom is equipped with humidifying apparatus to keep the cotton in the proper condition for spinning.

Although the department has been in operation only a short time, spoilage and rejections have been cut 50 per cent due to the better lighting, which facilitates visual inspection of the covering process. Furthermore, the flier, or spinner, speed on some of the machines has been stepped up from 2,000 r.p.m. to 4,500 r.p.m. and it is planned to do likewise on several more. This means a real step-up in production.

SPECIAL NOTICE

$10 will be paid for the best Operating Short submitted during the month of October. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

Guard Prevents Sticking of Oil Rings

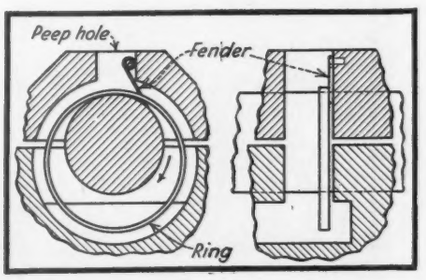
ELTON STERRETT, *Longview, Texas*

Every time the temperature dropped, lineshaft bearings ran hot; the colder the weather, the worse the bearing trouble. Investigation disclosed that the oil rings were sticking against one side of the bearing.

At ordinary temperatures the viscosity of the oil was sufficient to keep the ring moving, turning with the shaft, even when the ring travelled to the side of the oiling slot. When the oil thickened under the effect of cold, the ring stuck to the side of the slot, and trouble followed.

When the oiler discovered a "frozen" ring a mere touch was sufficient to free it and some time would elapse before the trouble appeared again.

Once the nature of this trouble had been determined, a simple fender or guard was devised which substituted point or line contact for the former wide area of contact between ring and bearing.



As the sketch shows, the ring revolving with shaft in the direction of the arrow is kept from rubbing against the side of the slot by the fender which is a piece of No. 14 wire held by a stove bolt near the top of the peep slot.

On some of the bearings that had given most trouble, it was found that with the fender pin in place the ring made 125 per cent more turns in a given time than it did with the pin lifted and the ring dragging against the bearing face. This

showed conclusively that even with the ring in motion its speed was considerably reduced by contact with the bearing.

Although weather conditions last winter were exceptionally severe, none of the pin-equipped, ring-oiled bearings gave trouble from "frozen" rings.

•

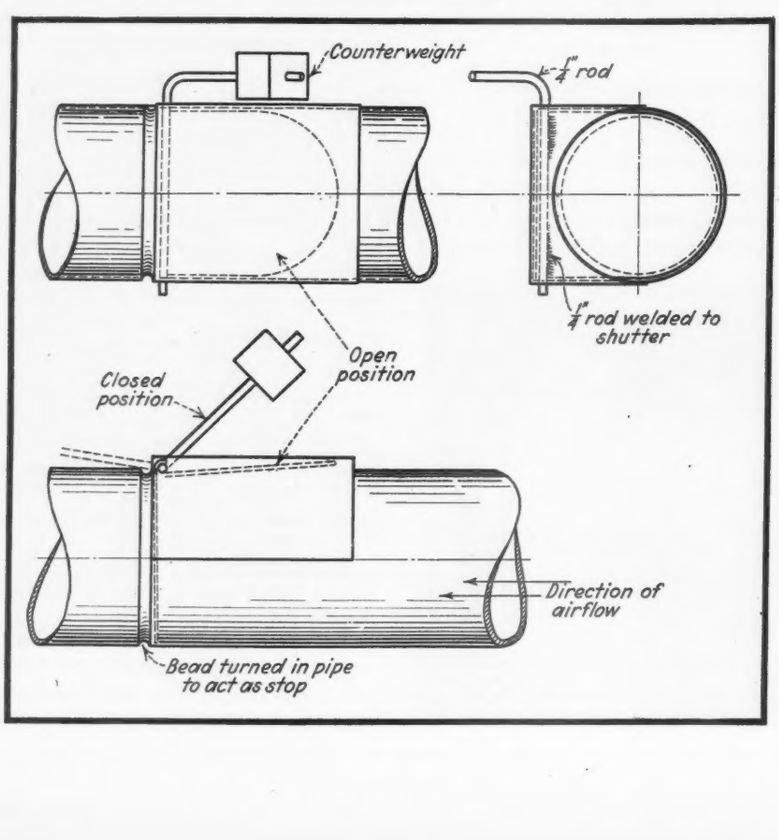
Blast Gate for Exhaust Systems

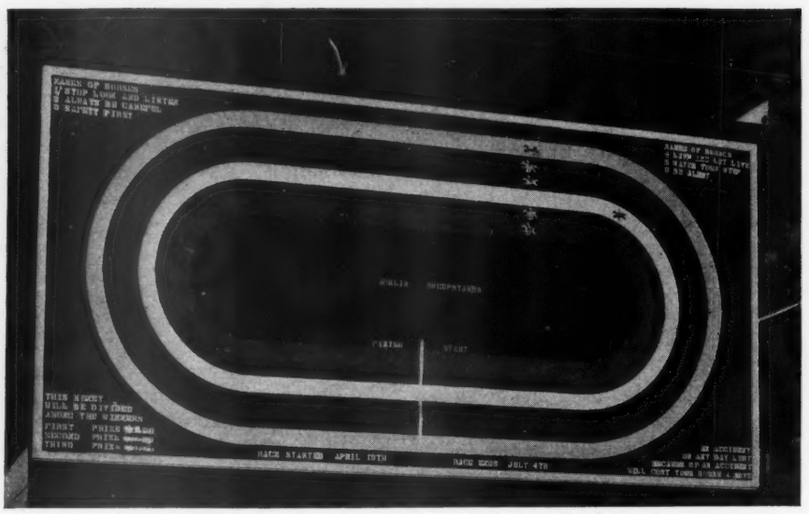
W. W. NASH, *Plant Engineer*
Independent Pneumatic Tool Company
Aurora, Ill.

The sliding - type blast gates usually employed in industrial exhaust systems were found to be very unsatisfactory because of the difficulty of closing them when they became slightly damaged and bent out of shape. To open or close the gates, workmen often used a hammer or some other tool that was handy, which, of course, did not make them any easier to operate.

Aside from the time wasted in struggling with the gates, in the event of fire in the duct it is essential to close the openings as quickly as possible.

The sketch shows the type of blast gate which we have adopted as standard for all exhaust systems. These gates have been made for use in pipes ranging from 2 in. to 6 in. in size, and have been found to be very satisfactory.





Where Gambling Promotes Safety

LEONARD CHURCH, *Cleveland*

The Acklin Stamping Company of Toledo finds it profitable to reward employees who avoid injury to themselves and to their fellow workers. These rewards are determined through a variety of safety contests conducted at intervals.

Called the "Acklin Sweepstakes," the latest contest made use of a large, brightly colored board depicting a race track divided into six lanes with miniature numbered horses mounted in each.

Nothing was invested in this contest by the employees, who organized in groups to pick a horse and promote its progress day by day for sixty days around the course, one move each day of the contest for the horses of groups that completed the previous day's work without an accident. Any injury requiring medical treatment or a lost day cost that group's horse a move.

To keep even "hard luck" employees interested, the number of moves lost (for more than seven days' lost time) was limited to five; for any injury from four to seven days, to four. This permitted a group to get back into the running if the others had a sequence of smaller misfortunes.

The plant nurse was referee and her decision regarding the seriousness of an accident was final. Ordinary first-aid calls did not count.

Cash prizes were given for the first, second, and third places. A tie was to be settled by an extra "heat" of thirty working days.

Jockeys were appointed in each division to whom employees could report hazards discovered in their departments, or the careless operation of any individual.

Further to implant safety consciousness in everyone's mind, the horses were named with such slogans as "Stop, Look and Listen," "Watch Your Step," "Safety First," "Always be Careful," "Live and Let Live," and "Be Alert."

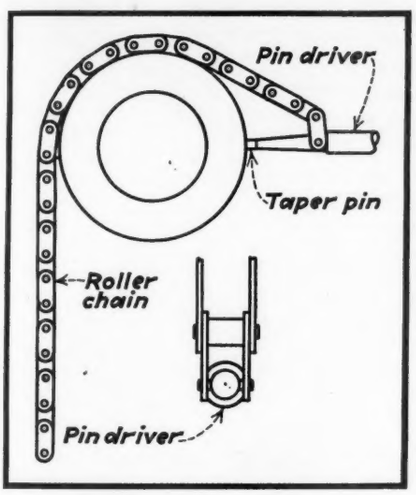
Inserts of cobalt-chromium-tungsten alloy in collets that hold bar stock while it is being machined are said to increase the life of the collets from 15 to 1,000 hours.

Taper Pin Driver Prevents Loss of Pins

H. MOORE, *Hamilton, Ontario*

When driving out taper pins it is a common experience to have them fly out very suddenly and become lost or, what is worse, drop into some part of the machine from which it is very difficult to retrieve them. The illustration shows a simple device that will prevent such mishaps.

It consists of a taper pin driver to which a length of old roller chain



is attached by removing one of the rollers and driving a pin through the links and the driver.

In use the chain is laid over the top of the shaft or other part so that it covers the head of the pin. The weight of the chain effectively prevents the pin from flying out of the hole when it is loosened by the blows of a hammer on the driver.

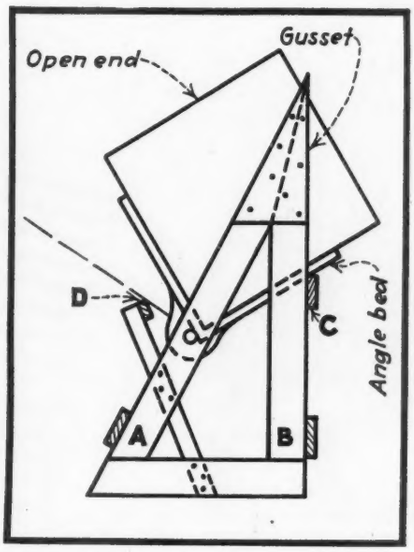
•

Tilting Stand for Boxed Parts

JOHN E. HYLER, *Peoria, Ill.*

Here is a stand that will hold a box of small parts at the proper height for the average workman, and tilted to a convenient angle for withdrawing stock. It is especially convenient for the inspector who must handle small parts piece by piece, in addition to its use at assembly benches and machines.

Two simple, right-angled triangles are constructed as shown, either of hardwood or welded metal parts. Wood has the advantage from the standpoint of lightness, whereas metal parts are stronger. Pieces *A* and *B* are joined together at the top, the joint being overlaid with a



plywood or boiler plate gusset. The two triangles are fastened together to make a self-supporting structure. Between them is mounted a swing-type angle-bed to support the container. This angle-bed is fitted with heavy ears and is supported on a shaft which passes through both triangles.

The crosspiece *C* serves as a stop to hold angle-bed in position. As the supply of parts in the box becomes lowered sufficiently to make it possible to do so without spilling, the angle-bed is swung forward until it encounters the front crosspiece *D*, in which position it is easy to empty the container.

•

Public Address System for Intra-Factory Communication

GERALD M. GOLDEN
Financial Independence Founders, Inc.
Boston

One manufacturer of automotive electrical equipment found it difficult to keep in touch with departmental foremen and executives because of the noise set up by operation of batteries of automatic screw machines and stamping presses. This problem was solved by the installation of a public address system. Formerly it was necessary to telephone to the department and request that the foreman or executive be called to the telephone. This method of communication was badly handicapped by the high noise level—messages had to be repeated back and forth a number of times with consequent delays and irritations.

Under the new arrangement the office can instantly locate anyone in any part of the factory by loudspeaker call. The 25-watt audio output can be clearly heard above the machinery's roar in the most remote corner. The system is a great time saver as executives can proceed to follow office directions immediately, without running to and from the telephone stations.

The installation consists of a six-tube power amplifier with a built-in field supply, a double-button microphone, dynamic loudspeakers in the various departments, and a switching system which allows the loudspeakers to be cut in and out at will. Cabled leads in metal pipe carry the voice and field currents to the loudspeakers.

As the amplifier has greater output than actually needed, line losses to the loudspeakers, which in some instances are 175 ft. away from the amplifier, are compensated for without the use of line-matching transformers. Amplifier tubes are "quick heaters"; the amplifier, therefore, is using power only when transmissions are being made. The short warm-up period, a matter of a few seconds, is used by the call system operator to throw the switches that allow the proper loudspeakers to be cut in.

This installation has worked so well that this manufacturer is adding additional equipment so that two-way communication can be obtained.

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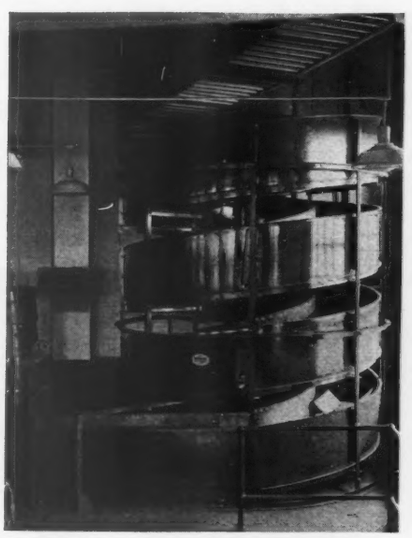
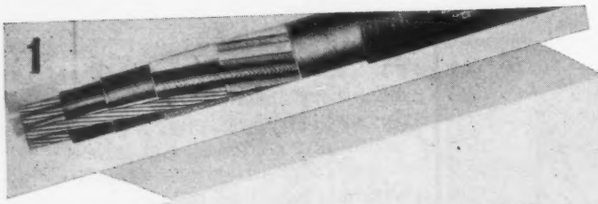
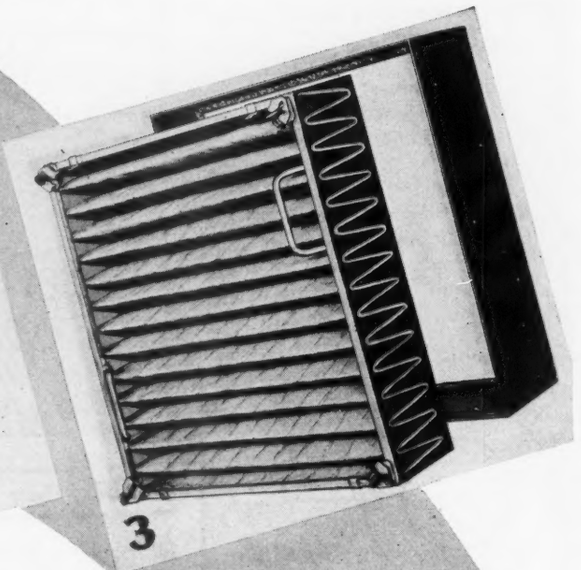


Source, Mathews Conveyor Company Ellwood City, Pa.

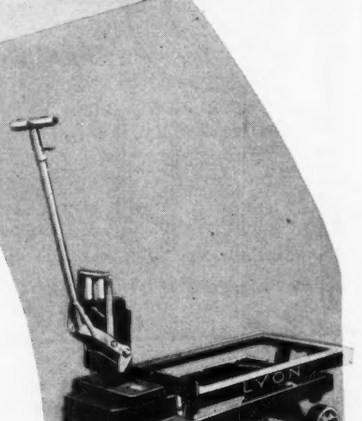
When floor space is scarce and when the product has to be handled right side up with care—in this instance, it happens to be incandescent lamps—the spiral gravity chute is indicated

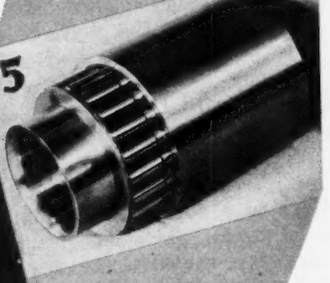


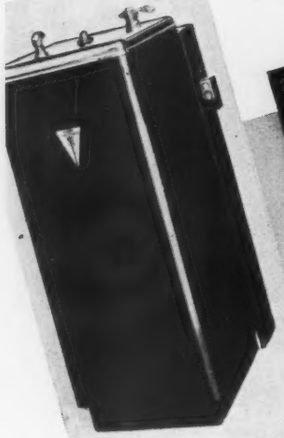


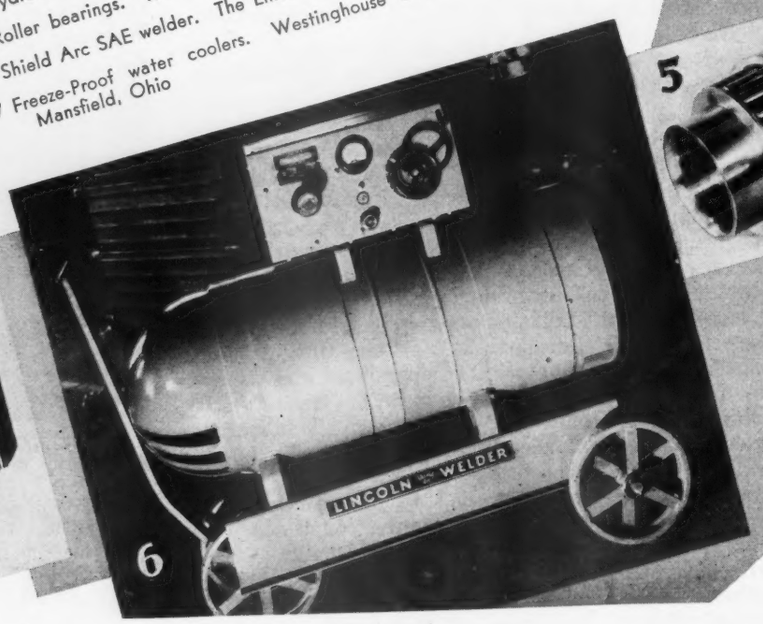
Flashes from the equipment makers

1 Powerduct cable. Anaconda Wire & Cable Co., New York
2 Portable paint spraying outfit. Binks Mfg. Co., Chicago
3 Airmat PL-24 air filter. American Air Filter Co. Inc., Louisville, Ky.
4 Hydraulic lift truck. Lyon Iron Works, Greene, N. Y.
5 Roller bearings. The Fafnir Bearing Co., New Britain, Conn.
6 Shield Arc SAE welder. The Lincoln Electric Co., Cleveland
7 Freeze-Proof water coolers. Westinghouse Electric & Mfg. Co., Mansfield, Ohio









What's NEW in Equipment

Air Conditioning, Ventilating, Heating

FILTER—"Airmat PL-24" filter unit with interchangeable filter element and frame. Element is composed of two matched serrated sections which support the Airmat in deep pleats to provide maximum filtering area. Size: 24 in. square by 8 5/16 in. deep. Rated: 1000 cu. ft. per min. American Air Filter Co., Inc., Louisville.

FILTERS—Permanent air filter made of 24 or 16 layers of media. Can be cleaned by washing in light oil. Stock sizes are 2 and 4 in. thick in areas 10x20, 20x20 or 16x24 in. Air-Maze Corp., Huron Rd., Cleveland.

UNIT HEATER—Electric unit heater with dual heating control, one for high heat and quick heating, one for maintainng temperature. Maximum Btu. output is 20,500. Hexcel Radiator Co., Racine, Wis.

UNIT HEATER—Four new sizes of "Grid" unit heater. Capacities at 2-lb. steam pressure and 60 deg. F. air temperature range from 56,750 Btu. with 1,290 cu. ft. per min. air volume at the fan to 248,000 Btu. with 5,300 cu. ft. per min. Unit Heater & Cooler Co. Wausau, Wis.

Bearings

BABBITT—Tin base babbitt for applications where high speed, severe vibration, heavy impact are encountered. In 5-lb. bars. The Bunting Brass and Bronze Co., Toledo.

BALL BEARINGS—Series 9500. For machine tools where great compactness is required. In bore sizes ranging 20-260 mm. The Fafnir Bearing Co., New Britain, Conn.

ROLLER BEARINGS—Series of heavy duty roller bearings. Rated capacity ranges 10,000-500,000 lb. Eighteen different bores available. Large number of solid rolls. The Fafnir Bearing Co., New Britain, Conn.

Communication and Signaling

SIGNALING EQUIPMENT—Code transmitting units for connection to bells, chimes, horns, etc. Operator inserts plug in code opening. Correct number of impulses is then transmitted. Can be operated on 110-, 220-, or 250-volt systems. Autocall Co., Shelby, Ohio.

SIGNALING UNIT—"Kodaire." Makes trumpet blast that can be heard through shop noises. Operates on 110 or 220 volts, 50 cycles or higher. Weatherproof housing. Schwarze Electric Co., Payne St., Adrian, Mich.

Electrical Control

CLOCK SWITCH—"Little Giant Tork Clock." Automatically controls electrical circuits. Has 5,000 watts capacity for either single- or double-pole service. Can be set on variable schedules without use of tools. Tork Clock Co., Mount Vernon, N. Y.

CONTROL—Micromax electric control for proportioning input to demand. Consists of control instrument, relay detector, and valve mechanism. Leeds & Northrup Co., 4909 Stenton Ave., Philadelphia.

RELAY—Out-of-step relay designed to prevent continued operation of synchronous machines out of synchronism with connected system. General Electric Co., Schenectady.

RELAY—Solenoid relay. Single-pole, double-throw with double break on both throws and separate, isolated contactors. Contacts and contactors are of silver and handle 100 watts on each circuit. Acusto-Lite Laboratories, South Vermont Ave., Los Angeles.

RELAY—Thermal relay assembly consisting of relay and heating element sealed in metal block of waterproof construction. Can be used for timing alarms or lights, connecting and disconnecting heating elements in heating equipment, liquid level indicator. Thomas A. Edison, Inc., West Orange, N. J.

SWITCH—Multiple-point switch. As many as 36 contact points can be used. Two solenoids are employed, one to advance contact finger step by step, other to reset switch. Operates on d.c. voltage from 6 to 120; Guardian Electric Mfg. Co., West Walnut St., Chicago.

SWITCHES—Mechanically held remote-control switches for use where a.c. hum of electrically held switches may be annoying. Rated at 75 amp., 2 poles. Available also in ratings 30-300 amp., 2- and 3-poles. Zenith Electric Co., Chicago.

SWITCHGEAR—Metal-clad switchgear of 7.5 kv. rating. Has four units each housing a 3-pole, 800-amp., solenoid-operated oil circuit breaker with current transformers, relay, disconnectors. Fifth unit houses three potential transformers and a 3-pole disconnecting switch. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

TIME SWITCH—Automatic time switches with synchronous, self-starting motors for temperature, stoker, heater control, and special requirements. In 15 and 40 amp., one- and two-pole sizes. Zenith Electric Co., Chicago.

Electrical Distribution

CABLE—"Powerduct" flexible cable containing three 600-volt rubber-insulated conductors and one bare ground conductor. Each conductor has 7 strands of tinned soft-annealed wire. Said to resist deterioration by oil, grease, and gasoline. Anaconda Wire & Cable Co., 25 Broadway, New York.

Electrical Protection Devices

CIRCUIT BREAKER—Type FKO–227 outdoor oil-blast circuit breaker. Interrupting rating, 50,000 kva.; interrupting time, 8 cycles. Double- or triple-pole models. Manual or electrical control. General Electric Co., Schenectady.

FUSE CLAMP—"Fuse Clip Clamps" consisting of clamping ring, which is forced over outside of jaws, and a knob by which the ring is tightened. Clamps insure better contact and prevent pitting of fuses and contacts. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.

Exhaust Systems

FAN, EXHAUST—Ratings 2,250-4,500 cu. ft. per min. Blades of Duralumin. Inclosed motor rated at ⅛ hp. for 16-in. unit, ¼ hp. for 18- and 24-in. units. Peerless Electric Co., Market St., Warren, Ohio.

Filtering, Clarifying, Mixing

CENTRIFUGAL MACHINE—Has fume-proof cover which cannot be opened while machine is in motion. Machine is driven from the bottom. Rochester Engineering & Centrifugal Corp., Buffalo St., Rochester, N. Y.

Grinding and Buffing

BUFFING COMPOUND—"Purico Wonderbar." Said to wash free from grooved work. Requires no brushing or scrubbing; will not tarnish work. The Puritan Mfg. Co., Waterbury, Conn.

GRINDER—Disk grinder with balanced operation, quick, automatic adjustment. Table can be tilted downward 45 deg., upward 25 deg. Disk is 18 in. in diameter. Exhaust fan. Motor may be ¾, 1, or 1½ hp. Kindt-Collins Co., Elmwood Ave., Cleveland.

Instruments and Meters

AMMONIA METER—Made of materials resistant to liquid ammonia. Totalizing unit, graduated in pounds, registers flow. Pittsburgh Equitable Meter Co., 400 North Lexington Ave., Pittsburgh.

ANALYZER—For radio receivers and electronic equipment. Is 50-microamp. instrument with sensitivity of 20,000 ohms per volt. Four resistance ranges, top range giving deflection to 30 megohms. Weston Electrical Instrument Corp., Newark, N. J.

CONTROLLERS—Model D40M low-range recording gages and controllers for draft or pressure. Inclosed-bell-type measuring elements. Minimum ranges 0-0.2 in. of water; maximum ranges, 0-2.0 in. of water. The Bristol Co., Waterbury, Conn.

DIAL INDICATORS—Full-jewelled, low-friction dial indicators for precision measurements. Light and free action, uniform and constant pressure, and little needle flicker are claimed. Federal Products Corp., Providence.

DRAFT GAGE—Vest pocket size draft gage. Claimed to be readable to 1/100 in. draft. Has range from 0.14 in. up-draft to 0.10 in. down-draft. Bacharach Industrial Instrument Co., Pittsburgh.

MICROMETER—Micrometer calipers with hardened, ground, and lapped leadscrew. Swedish Gage Co. of America, Woodward Ave., Detroit.

pH METER—Coleman portable pH electrometer. Self-contained, it features direct-reading dial, factory-sealed glass-and-calomel electrodes, range of 1 to 10 pH. Wilkins-Anderson Co., North Canal St. Chicago.

POLARISCOPE—For strain testing of glass. Glass is placed on top surface of instrument and several people can watch the result at the same time. Instrument does not have to be operated in dark room. R. Fuess, Inc., 245 West 55th St., New York.

THERMOMETER—Tank thermometer for indicating temperatures of pickling baths, cleaning or neutralizing tanks. Range is 100-220 deg. F. Ferro Enamel Corp., East 56th St., Cleveland.

TIMER—Has 24-hour dial on which trips can be set to turn equipment on and off. Capacities of 15 and 40 amp. Has synchronous self-starting motor. Zenith Electric Co., Inc., 605 South Dearborn St., Chicago.

Lighting

LIGHTING UNIT—Combination mercury and incandescent lamp diffusers. Units accommodate one 250-watt mercury lamp and either one 300-watt or two 150-watt incandescent lamps. Gives soft light simulating daylight. Benjamin Electric Mfg. Co., Des Plaines, Ill.

LIGHTING UNIT—Combines mercury vapor light and incandescent light in single unit to give a daylight effect. Mercury vapor light is 33-in. tube, 1 in. in diameter, above which are mounted four 150-watt Mazda lamps. Aluminum reflector. General Electric Vapor Lamp Co., Hoboken, N. J.

Lubricants and Lubricating Devices

INSTRUMENT LUBRICANTS—Four lubricants for instruments and delicate devices.

Two are blended oils, two not. They serve as rust preventives for steel parts, lubricate complicated mechanisms. Mann Instrument Corp., Cambridge, Mass.

MOLD LUBRICATOR—Device for lubricating molds in automatic glass pressing. A single drop of oil is atomized in stream of air, and while oil fog continues, a torch carburizes the oil coating inside the mold. C. A. Norgren, Inc., Denver Col.

OILER—Wick-feed oiler with transparent plastic body. Level of oil can be seen at any time. Gits Bros. Mfg. Co., South Kilbourn St., Chicago.

TROLLEY OILER—Automatically lubricates conveyor trolley wheel by releasing a jet of oil fog over the bearings and links when trolley wheel trips release trigger. J. N. Fauver Co., 91 Selden Ave., Detroit.

Materials

COPPER ALLOY—"Hackett K-Copper." Hardness of 70 to 80 Rockwell B, 125 to 150 Brinell. Ultimate strength 70,000 lb. per sq. in. Available in bars, forgings, and castings. Can be used for welding tips and holders. Hackett Brass Foundry, Detroit.

FLANGED TUBING—Flanged monel metal tubing. Available in 1¾, 2 and 2½ in. O. D. sizes of welded monel metal tubing in standard lengths of 10 and 12 ft. International Nickel Co., 67 Wall St., New York.

GALVANIZED STEEL—"Paintgrip" galvanized steel sheets. Have special protective coating that keeps paint from direct contact with zinc, giving surface with good adhesion and chemical neutrality that retards aging of paint. American Rolling Mill Co., Middletown, Ohio.

Materials Handling

CARBOY RACK—Assembly of channel members formed as a rocker and welded. Carboy rides on cradle back of center so that carboy is kept tilted with opening upward. Mossberg Pressed Steel Corp., Attleboro, Mass.

TRUCK, LIFT—Double-duty, hinged-frame hand-lift truck for handling skids of different underclearance. Hinged-frame is dropped down onto regular frame for skids having high clearance. Yale & Towne Mfg. Co., Philadelphia.

TRUCK, LIFT—Hydraulic lift truck with 10-in. elevation. Regular frame lifts 6 in., and by use of auxiliary frame 10-in. lift is obtained. Frame is arc welded. Ball bearings in wheels and steering mechanism. Lyon Iron Works, Greene, N. Y.

TRUCK, LIFT—Model XB multi-stroke, hand-lift truck. Lift of 10 in., capacity of 8,000 lb. Chain lift; hydraulic release check. Yale & Towne Mfg. Co., Philadelphia.

Mechanical Power Transmission

BELT COUPLING—For V belts. Has two formed steel stampings which fit over belt ends, and one link of roller chain which fits between the ends. Shippert Mfg. Co., Dixon, Ill.

PULLEY—Magnetic pulley with corrugated radial openings centrally located in each magnetic pole. Air is forced through openings and out through corrugated longitudinal ducts. Dings Magnetic Separator Co., Milwaukee.

Metal Finishing

PLATING MACHINE—"Model B Circo Machine." Said to have low electric current consumption and thermostatically controlled gas heater is said to be economical on gas consumption. Circo Products Co., Cleveland.

SANDING MACHINE—"Tu-Spede." By shifting small knob in housing either of two speeds, 3,800 or 1,000 r.p.m., can be obtained. High speed suitable for sanding and wire brushing, low speed for polishing. James Clark, Jr., Electric Co., Bergman St., Louisville.

Metal Working

BRAZER—Electric brazer for brazing saw bands up to 1½ in. wide. For 110- or 220-volt, single-phase, a.c. circuits. Grob Bros., West Allis, Wis.

BROACHING MACHINE—Automatic broaching machine with indexing mechanism consisting of rotary work table and slide, and an indexing change gear box driven by an electric motor. Table can be tipped to any degree, is 30 in. in diameter. La Pointe Machine Tool Co., Hudson, Mass.

CASCADE MILL—Removes scale from forged parts. Forging held in suspension of steel grit and hardened stars of graded sizes while mill tumbles them. N. Ransohoff Inc., West 71st St., Carthage, Cincinnati.

CORE STRIPPER—Quick-drawing core stripper. Strips boxes of any shape provided sides of box make 90-deg. angle to the face. Operated by pressure on foot pedal. Myron C. Kline, West 28th St., Erie, Pa.

DIE-CASTING MACHINE—Model B-3 vertical die-casting machine particularly adapted to parts requiring long inserts. Plunger pressure up to 1,500 lb. per sq. in. Kux-Lohner Machine Co., Lexington St., Chicago.

DRAWING PRESS—No. 4282 "Duo" hydraulic drawing press. Designed to draw large shallow pieces, it permits use of cheaper grades of drawing steel. Capacity is 200 tons. Stroke is 18 in.; platen surface 61x43½ in. Charles F. Elmes Engineering Works, Morgan & Fulton Sts., Chicago.

DRILLS—No. 15. Heavy duty production drills in bench and floor models. Have 5 speeds; will drill holes up to ½-in. Tables can be tilted to any angle. Buffalo Forge Co., 471 Broadway, Buffalo.

FACING MACHINE—Automatic machine for facing seats on standard brass gate valves and wedges up to 2-in. size. Finishes both seats simultaneously with roughing and finishing cut. By changing work-holding fixtures both body and wedge can be finished on same machine. Automatic Machine Co., Bridgeport, Conn.

FURNACE, HARDENING—Pot hardening furnace for use with lead, cyanide, neutral salts, or carburizing salt as heating medium. Bottom slopes downward to combination drain and vent. Contents heated from top downward. American Gas Furnace Co., Elizabeth, N. J.

GEAR FINISHER—Enveloping gear generator for finishing spur and helical, internal and external gears. Tools are made without outside angle or side clearance to teeth, and drive the work. No. 4 takes gears up to 5 in. pitch diameter, No. 8 up to 8 in. Fellows Gear Shaper Co., Springfield, Vt.

METAL CUTTING MACHINE—Semi-automatic machine for cutting any light-section material. After material is manually started, it is automatically pushed against stop, clamped by automatic vise, and cut off. Three central stations. De Walt Products Corp., Lancaster, Pa.

MILLING MACHINE—No. 2-MH for small and medium-size work pieces in toolroom or job-lot quantities. Plain and universal machines are built. Ranges: 28 in. longitudinal table travel, 10 in. cross travel, and 19 and 18 in. vertical travel. Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati.

MILLING MACHINE—"Rigidmil" hydraulic milling machine. Traverse of 72 in. in both directions. Operating cycle is automatic and easily adjusted. Sundstrand Machine Tool Co., Rockford, Ill.

PRESS—Addition to "Bliss-Consolidated" line. Heavy duty, adjustable-stroke, inclinable press. Single-geared and arranged for direct-connected motor drive. Operates at 40 strokes per min. when geared. E. W. Bliss Co., Brooklyn.

PRESS—Forcing press No. 1352 operates on 80-lb. air pressure. Has two 8-in. cylinders placed end to end and two pistons mounted on the ram. Gap measures 8 in.; stroke is 3 in. Hanna Engineering Works, Elston Ave., Chicago.

PRESS—Model-5 hydraulic forcing press for forcing valve guides into V-type cylinder block. Capacity is 40 tons. Dorr-Patterson Engineering Co., Wight St., Detroit.

RIVETER—Pneumatic squeeze riveter. Exerts 10 tons pressure on die, sufficient to drive ¼-in. cold rivets or ⅜-in. hot rivets. Is suspended from spring balance to make portable tool. Hanna Engineering Works, Elston Ave., Chicago.

SAWING MACHINE—"JXD" precision sawing machine. Has throat 25 in. deep. Designed for combination sawing and filing for internal and external work. Table area is 22x30½ in. Continental Machine Specialties, Inc., Minneapolis.

SCREW MACHINE—No. 2 wire-feed screw machine. Motor or overhead drive models. For small jobs or for jobs subject to frequent changes. Twenty spindle-speed changes on motor-driven model, 9 on overhead drive. Brown & Sharpe Mfg. Co., Providence.

SHAPER—Double-spindle shaper operating at 10,500 r.p.m. Spindles are driven by two vertical motors and can be adjusted vertically a total of 3½ in. Belt drive. Pushbutton control. Baxter D. Whitney & Son, Inc., Winchedon, Mass.

SHEARS—Series HL Power Squaring Shears. For high production flat strip cutting. Capacity of 10-gage metal. Large opening between holddown bar and crosshead, giving perfect vision to cutting line. Unobstructed vision from front of machine to back. Niagara Machine & Tool Works, Buffalo.

STRAIGHTENING ROLL—Rotary straightening roll consisting of two power-driven tool-steel straightening rolls mounted in anti-friction bearings. Angle of tilt of rolls may be varied. Capacity: ¼–¾-in. steel rounds and 1⅛-in. tubing. Kane & Roach, Syracuse.

Miscellaneous

ABRASIVE CHART—Wall chart containing directions for setting up polishing wheels. Measures 11x14 in. General Abrasive Co., Hyde Park Blvd., Niagara Falls.

CABLE FITTINGS—Wire rope and cable fittings which hold ends of stranded wire ropes or cables by bending them over or around and passing them through a tapered metal plug inclosed in a steel body. Will accommodate rope and cable in sizes from ¼ to 1 in. Electroline Co., 4121 South La Salle St., Chicago.

CAN FILLING MACHINE—Type A-4. For all can sizes from 4 oz. to 2 gal. Fills 60 one-quart cans or 30 five-qt. cans per min. Crandall Can Filler Machine Co., Niagara St., Buffalo.

CEMENT—Acid-proof sulphur cement. Can be used in construction of acidproof masonry lining for tanks and containers and for laying acidproof floors. Atlas Mineral Products Co., Mertztown, Pa.

CONTROLLER—Combines hydraulic and electric device for remote feed-pump control. As two solenoids are energized and de-energized, they operate pilot valves and select flow of oil to control cylinder. Oilgear Co., Milwaukee.

DRAFTING MACHINES—Have adjustable brake mechanism to prevent protractor head from sliding excessively when used on inclined board. Adjustable skid buttons for leveling scales. Parts are of dull-finish aluminum or baked enamel. Charles Bruning Co., Inc., 102 Reade St., New York.

DRIP NOZZLE—Self-cleaning drip nozzle delivering any quantity up to 9 qt. of water per hr. By turning adjusting nut flow is changed. Is ½ in. in diameter and 3¾ in. long. Rega Mfg. Co., Rochester, N. Y.

ENAMELING FURNACE—"Gas-Fired Radiant Tube Furnace" for porcelain enameling. Tubes are placed on the hearth and along sidewalls of furnace. Gas burns in the tubes and never comes in contact with ware being fired. Ferro Enamel Corp., Cleveland.

FILLING MACHINE—Designed principally for small containers but can be used to fill jars, boxes, bags up to 5 lb. capacity. Has rotary plate upon which operator places containers. Stokes & Smith Co., Summerdale Ave., Philadelphia.

FILTER—Self-cleaning filter for use on grinders and other applications where continuous flow of clean liquid is required. Two capacities: 18 and 30 gal. per min. Motor Improvements, Inc., 365 Frelinghuysen Ave., Newark, N. J.

HEAT-EXCHANGER TUBE—Tube with fins on surface in form of helix with no joint

NEW Equipment · Machinery · Materials · Supplies

at the tube. In copper or aluminum in diameters from ⅝ to 4 in. Wolverine Tube Co., Detroit.

KILN END NOSE RINGS—Segment rings made of Amsco Alloy, for use in all sizes and types of rotary kilns. Eliminate danger to kiln brick and end linings. Consist of 8 segments, each made with ample expansion and contraction space on seal lip, and held together by butt straps. American Manganese Steel Co., 377 East 14th St., Chicago Heights.

METAL SPRAY GUN—Improved gun has compressed-air turbomotor which, through a speed reducer, feeds wire into oxy-acetylene flame. "Hi-Cap MetaLayeR." Metals Coating Co. of America, North Third St., Philadelphia.

NOZZLE—Spray nozzle for descaling strip, plate, and bar steel. Consists of stainless steel body, tapered self-locking spray disk of stainless steel, and a strainer of corrosion-resisting material. Worthington Pump and Machinery Corp., Harrison, N. J.

SAMPLER—Sampler for liquid caustic in tank cars. Tube support carries brackets holding five sampling bottles so that samples can be taken from different layers at same time. Operating handle lifts and replaces corks. Mathieson Alkali Works, Inc., 60 East 42d St., New York.

SANDING MACHINE — "Superior Air-Rubbing Machine" for sanding, rubbing, or polishing flat surfaces. Felt holders are used with rubbing compounds or rotten stone. Paasche Airbrush Co., 1901 Diversey Parkway, Chicago.

SEALING MACHINE—"Stylus" sealing machine crimps and heat-seals Cellophane bags. Operating chain connects footpedal to hinged top assembly containing heating element. Harry A. Unger, South Olive St., Los Angeles.

SLIDE RULE—Kurtz psychrometric slide rule. Intended to replace charts and tables. Dimensions, 11x1⅝ in. Finished in white enamel with black figures. The Keuffel & Esser Co., Hoboken N. J.

SWITCH—No. 66-DB float-operated switch for controlling liquid levels. Can be used as low water cutoff or to protect against high water levels and overflow. Consists of mercury switch inside a float which is attached to head by metallic bellows. McDonnell & Miller, Wrigley Bldg., Chicago.

TABLET MAKING MACHINE—Forms tablets up to 3 in. in diameter, 1 in. in thickness. Has rotary head accommodating up to 6 punches. Makes up to 180 tablets per min. Kux-Lohner Machine Co., Lexington St., Chicago.

UTILITY CABINET—Utility cabinet for small parts. Steel construction. Each drawer has label holder. Draws swing on pivot so that they are permanently attached and cannot spill. Yawman & Erbe Mfg. Co., Rochester.

Molding

PRESS—Self-contained molding press in four sizes from 50 to 300 tons capacity. Two-stage, motor-driven rotary pump, supplying pressure for ram, is controlled by single-lever, four-way valve. Maximum pressure maintained is 600 lb. per sq. in. Standard Machinery Co., Mystic, Conn.

Motors

MOTOR BASE—"Sound-Pruf" base for motors, fans, blowers, etc. Has floating platform suspended by rubber balls set in recesses between parallel flanges. Used with belt drives. W. D. Fabling Co., Sacramento St., Los Angeles.

MOUNTING—Risilient mounting for electric motors and machinery. Consists of floating platform suspended by resilient rubber balls set in recesses between parallel flanges. General Electric Co., Schenectady, N. Y.

Paint and Painting Equipment

NOZZLES AND ATOMIZER HEADS—Improved designs of fluid nozzles and atomizer heads for paint spray guns. For siphon or force feed and in sizes and styles to handle fine lacquer and heavy synthetic enamel. The Alexander Milburn Co., 1416 West Baltimore St., Baltimore.

PAINT—"Modex." Casein paint in powder form to be mixed with water. Manufacturer says it will not peal or discolor. The Reardon Co., St. Louis.

PAINT—"Surfaseal" rubber paint. Applied to metal by brushing or dipping. Is resistant to acids and is a corrosion inhibitor. Collord, Inc., Rosedale Court, Detroit.

PAINT PRIMER—"K-Cemo." Is used by mixing with water and applying to concrete, plaster, or wallboard. Applied with calcimine brush to old or new surfaces. United States Gypsum Co., West Adams St., Chicago.

PAINT SPRAYER — Rubber-tired paint spraying unit for interior and exterior painting. Consists of ½-hp. electric motor, air compressor, 2-gal. pressure tank, bleeder type spray gun with adjustable nozzle. Binks Mfg. Co., 3114 Carroll Ave., Chicago.

PROTECTIVE COATING — "Coppercote." A pure metallic copper held in suspension in a special vehicle. Prevents corrosion of metallic surfaces, protects wood surfaces against termites and marine borers. Applied by brushing, spraying, or dipping. American Coppercote, Inc., 480 Lexington Ave., New York.

RESIN—For use in cellulose ester lacquer of high gloss, high solid-content type. Suitable for automobile, refrigerator, furniture finishing, for fixtures and imitation tile. Bakelite Corp., 247 Park Ave., New York.

Piping, Valves and Fittings

STEAM TRAP—No. 00026-T. Handles up to 430 lb. of water per hr. at 15 lb. pressure. Available for ½- and ¾-in. inlet openings. Monel valve piece and seat inserts. Warren Webster & Co., Federal St., Camden, N. J.

STEAM TRAP—"Super-Silvertop No. 10." For small steam-using units. Pressures 0-125 lb. Can be cleaned without removing from line. Valve and seat of chrome alloy, bucket of copper, working parts of stainless steel. V. D. Anderson Co., Cleveland.

VALVE—Two-handle, lift-type plug valve. First handle raises plug, second handle rotates plug through 90 deg. to new position. For pressures of 125 lb. and higher and temperatures up to 750 deg. F. Homestead Valve Mfg. Co., Coraopolis, Pa.

Power Plant Equipment

CENTRIFUGAL PUMPS — Direct-motor drives or with pulleys for belt drive. Motor sizes range from ⅛ to 3 hp., delivering 10-130 gal. per min. Heads from 10 to 100 ft. Worthington Pump and Machinery Corp., Harrison, N. J.

COMPRESSOR — Heavy duty compressor of single-stage, single-cylinder, double-acting, horizontal type. Sizes of 10-50 hp. for operation under pressures 5-150 lb. Available for any type drive. Sullivan Machinery Co., Michigan City, Ind.

DIESEL ENGINE—PD-80, 6-cylinder diesel power unit. Gasoline starting by means of cranking. Rated at 100 hp. maximum, 80 hp. continuous load; 1,400 r.p.m. Bore is 4¾ in., stroke 6½ in. International Harvester Co., 606 South Michigan Ave., Chicago.

DIESEL ENGINE—Type S. Vertical, 4-cycle, single-acting, solid-injection type for heavy duty continuous service. Made with 3, 4, 5, 6 and 8 cylinders for ratings from 150 to 460 hp. Ingersoll-Rand Co., 11 Broadway, New York.

GENERATOR UNIT — Model 25-FFNT. Consists of generator and Ford V8 engine. Rated at 25 kw. for 110-, 220-, or 440-volt service on 50 or 60 cycles, single-phase, double-phase, or three-phase. Bardco Corp., North Sycamore St., Los Angeles.

POWER PLANT—For welders, compressors, pumps, and so forth. Has heavy duty Ford V8 truck engine and large clutch, large-capacity radiator. Double V-belt drive. Battery and gasoline tank mounted in base. Engine is rubber-mounted. K. R. Wilson, Buffalo.

PUMP—Type SS-B centrifugal pump for V-belt drive. Also available for direct connection. For heads up to 100 ft.; 1¼- to 4-in. discharge. Impeller is bronze. Allis-Chalmers Mfg. Co., Milwaukee.

STOKER—Underfeed stoker for use in baking ovens, casting pots, etc. Hopper holds 350 lb. of coal, fed by screw conveyor. Three speeds for conveyor and air control. Safety shear pin protects conveyor. Will-Burt Co., Orrville, Ohio.

Printing

CUTTER—"Challenge 265 Lever Paper Cutter." Accurately cuts heavy lifts, it is claimed. Quick-acting back gage. Knife bar and lever are balanced. Strong center brace. The Challenge Machinery Co., Grand Haven, Mich.

Refrigeration

CONDENSERS — Type ECC evaporative condenser for Freon or methyl chloride, for indoor or outdoor installation. Capacities 4½ to 52 tons. Welded steel tank. Bronze nozzles. Buffalo Forge Co., Buffalo.

CONNECTION—Flexible connection for use in charging Freon refrigerating or air conditioning systems. Is 4 ft. long, made of seamless bronze bellows tubing with wire braid covering. Nut connections fit standard refrigerant cylinders. York Ice Machinery Co., York, Pa.

Safety Equipment

FLOOR MAT—"Safety-Cushion Akromat." Designed to provide nonslip resilient surface under-foot and eliminate fatigue and slipping hazards. Made of cotton cord links impregnated with rubber and woven on rust-proof spring steel. Buxbaum Co., Akron.

GOGGLE LENS COVER—In circular and rectangular forms to be fitted into frame of goggle or shield to protect lens against scratching, pitting, and breaking. Made of chemically treated plastic material. Sellstrom Mfg. Co., North Curtis St., Chicago.

MASK—Wire-screen mask with frame of black vulcanized fiber protects face and neck against flying particles. Industrial Products Co., North 8th St., Philadelphia.

RESPIRATOR—No. 36. Protects against dusts. A featherweight mask of aluminum with cotton gauze resting between mask and wearer's face, covering nose and mouth. C. H. Dockson Co., Detroit.

Sanitation

WATERCOOLERS — Models FWPF-8 FWPF-65, FWPF-14 especially designed to operate in temperatures below freezing (as low as —20 deg. F.). Capacities are 9.5, 11.9, and 14.4 gal. of water per hr., from 70 to 50 deg. F. Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

Textile

STAPLE CUTTER—Cuts Cellophane bands into staple for mixed spinning. Has 20-blade knife operating at 750 r.p.m. with synchronized feed for the Cellophane. Has ¼-hp. motor. F. J. Stokes Machine Co., Philadelphia.

STRIP CUTTING MACHINE—Bias collarette and strip cutting machine. Cuts directly from roll; can cut two or more strips at once. Less than minute is required to change for different widths. J. A. Firsching, Inc., Utica, N. Y.

Tools and Supplies

ABRASIVE HOLDER—Working part of tool is 9¼ in. long, handle is 3¾ in. long and of wood. Can be used on any operation where abrasive cloth or paper is used by hand. Keeler Mfg. Co., South Keeler Ave., Chicago.

DRAIN AUGER—Designed to remove stubborn plumbing obstructions in out-of-the-way places. Flexible rod, concealed in drum head when not in use, is quickly and easily fed into drains where it bores and twists its way through the stoppage. Sanitation Tool Mfg. Co., Chicago.

FLASHLIGHT SCREWDRIVER—Handle is transparent, non-conducting composition material containing two standard flashlight batteries and bulb. Blade is 5 in. long with 3/16-in. tip. Overall length is 10½ in. Bonney Forge & Tool Works, Allentown, Pa.

NUMBERING STAMP—Multiple-wheel assembly stamps numbers and letters. Wheels are hardened tool steel. Impression made by striking shank with hammer. Quality Die Co., South Baltimore Ave., Chicago.

PLIERS—No. B21 Lock Ring Pliers for removing lock ring washers. Will spread any lock ring washer up to 1¼ in. in diameter. Measures 8 in. overall. Bonney Forge & Tool Works, Allentown, Pa.

SOLDERING IRONS—Electric soldering irons for a.c. or d.c. current. Ventilated handles can be adjusted to desired length, or removed. Eight sizes ranging from 52 watts with 7/16-in. tip to 435 watts with 1 9/16-in. tip. The Stanley Rule & Level Plant, New Britain, Conn.

WRENCHES — "Superector" reversible ratchet wrenches. Quadruple pawls. Five sizes ranging 24-48 in. Both hexagon and square nuts. J. H. Williams & Co., 75 Spring St., New York.

Welding and Cutting

ELECTRODE—"Easyweld." For transformer-type arc welders. Intended for repairs on steel or iron and for light-gage steel welding. Shielded-arc type. Universal Power Corp., Euclid Ave., Cleveland.

REGULATOR—Pressure regulator for gas delivery pressures between 0 and 1,000 lb. per sq. in. Has two dials, one showing tank pressure, other working pressure. Torchweld Equipment Co., West Lake St., Chicago.

SPOT WELDING MACHINE—For welding small stampings, small wire products, toys, etc. Will weld sheet steel down to 18 gage. Rated at 3 kva., 220 volts, 60 cycles. Roth Welding Engineering Co., East Grand St., Detroit.

WELDER—"Shield Arc SAE." New method of arc control, it is claimed, makes possible adjustment of arc heat and arc penetration in continuous sequence of five increments. In ratings of 200, 300, 400, and 600 amp. The Lincoln Electric Co., Cleveland.

Wire and Wiring Devices

CONNECTOR—"Bondhub." A conduit-box connection by which rigid conduit may be firmly connected to a box. Consists of hub with threaded end to accommodate conduit, a telescoping flange sleeve to slip through knockout hole in box into hub, and a Wedgscru to drive through hub into countersunk hole in sleeve. National Electric Products Corp., Fulton Bldg., Pittsburgh.

CONNECTORS—Four connectors for watertight connections at meters and through cable entrances in walls. Rattan Mfg. Co., New Haven, Conn.

CONNECTORS—Model C-1 all metal coupling unit for single-conductor shielded cables. Is ¾-in. in diameter, 1½-in. long. Accommodates cable 5/16 in. in diameter or less. Bruno Laboratories, Inc., 20 West 22d St., New York.

Change of Name

The Edge Moor Iron Co., Edge Moor, Del., has been purchased by new interests and has resumed operation under the name of Edge Moor Iron Works. The firm will continue to manufacture power plant apparatus and plate equipment in iron, steel, and alloys.

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TRADE LITERATURE

Acid Pumps—Bulletin W-350-B1 type CG centrifugal acid pumps.—Worthington Pump and Machinery Corp., Harrison, N. J.

Air Conditioning Unit—Bulletin SW-06-A, on type SW-06 Mobilaire air conditioning unit.—Westinghouse Electric & Mfg. Co., Mansfield, Ohio.

Ammonia Compressors—Bulletin No. 36146, on vertical, single-acting ammonia compressors.—York Ice Machinery Corp., York, Pa.

Bakelite—Booklet, seventh edition of "Bakelite Molded."—Bakelite Corp., 247 Park Ave., New York.

Cable—Bulletin S82, on Super Service Portable Cable.—General Cable Corp., White Plains, N. Y.

Castings—Folder, describing beryllium copper castings.—The Beryllium Corp. of Pennsylvania, Reading, Pa.

Centrifugal Pumps—Two bulletins: W-321-B4B, on Nos. 3 and 4, type DE; W-321-B9, on Nos. 1½, 2, and 2½, types DE, DF and DG.—Worthington Pump and Machinery Corp., Harrison, N. J.

Circuit Breakers—Four Bulletins: Section 1 and Supplement 1 of Catalog 5 on type HD air circuit breakers; Section 2 of Catalog 5, on "Industrial" type air circuit breakers; Section 3 of Catalog 5, on type BD air circuit breakers.—Roller-Smith Co., 233 Broadway, New York.

Control Equipment—One hundredth anniversary catalog, listing complete line of switches, fuses and fuse accessories, cast iron boxes and fittings, and other types of safety equipment.—Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.

Dehumidifier—Folder, describing dehumidifier for humidity control.—The Lamson Co., Inc., Syracuse, N. Y.

Diesel Engine—Booklet, describing type S diesel engine.—Ingersoll-Rand, 11 Broadway, New York.

Diesel Engine—Folder, describing PD-80 six-cylinder diesel power unit.—International Harvester Co., 606 South Michigan Ave., Chicago.

Fire Extinguishing—Booklet, title "A Discourse on the Chemical Aspect of Fire."—Walter Kidde & Co., 140 Cedar St., New York.

Fire Extinguishing—Folder, on Phomaire Play Pipe and Phomaide Solution for fighting fires.—Pyrene Mfg. Co., 560 Belmont Ave., Newark.

Flanges—Bulletin No. 125, on line of forged steel flanges.—Kropp Forge Co., Roosevelt Rd., Chicago.

Flooring Material—Folder, on Stonhard Resurfacer for floor repairs.—Stonhard Co., 405 North Broad St., Philadelphia.

Instruments—Three bulletins: Section 1 of Catalog 123, on portable electrical measuring instruments; Section 1 of Catalog 240, on precision balances; Catalog 830, on graphic instruments.—Roller-Smith Co., 233 Broadway, New York.

Instruments and Controls—Booklet, on instruments and controls for air conditioning.—Julien P. Friez and Sons, Inc., Baltimore.

Insulating Materials—Catalog, listing and describing line of insulating products.—Johns-Manville, 22 East 40th St., New York.

Insulating Materials—Catalog No. 11, listing various types of electrical insulating materials.—William Brand & Co., 268 Fourth Ave., New York.

Low Water Cutoff—Leaflet, describing No. 66-DB low water cutoff.—McDonnell & Miller, Wrigley Bldg., Chicago.

Mills—Brochure, on grinding and mixing mills.—The Patterson Foundry & Machine Co., East Liverpool, Ohio.

Nickel—Folder, listing available booklets on the application of nickel to various industries.—The International Nickel Co., Inc., 67 Wall St., New York.

Piping—Folder, on Masterflex piping.—The M. W. Kellogg Co., Jersey City.

Piston Pumps—Two bulletins: W-101-B4B, on type VD duplex; W-102-B1A, on type TB horizontal duplex.—Worthington Pump and Machinery Corp., Harrison, N. J.

Presses—Two bulletins: No. 201, on crankless steel power presses; No. 202, on Clearing single-action presses.—Clearing Machine Corp., 6499 West 65th St., Chicago.

Protective Coating — Folder, announcing "Coppercote," a protective coating of pure metallic copper.—American Coppercote, Inc., 480 Lexington Ave., New York.

Pump and Receiver—Bulletin W-101-B6, on type VG horizontal duplex steam pump and receiver sets.—Worthington Pump and Machinery Corp., Harrison, N. J.

Recording Meters—Bulletin No. 436, covering line of round chart recording voltmeters and ammeters.—The Bristol Co., Waterbury, Conn.

Regulators and Controllers—Sections 1, 2, and 3 of Catalog 10, on three different types of regulators and controllers.—Roller-Smith Co., 233 Broadway, New York.

Resins—Booklet, on powders, solution, colloids.—General Plastics, Inc., North Tonawanda N. Y.

Rotary Table—Folder No. 33, describing Wheelabrator Multi-Rotary Table for cleaning castings.—The American Foundry Equipment Co., 555 South Byrkit St., Mishawaka, Ind.

Screws—Catalog No. 36, on line of screws.—Elco Tool & Screw Corp., Rockford, Ill.

Sedimentation Basin—Booklet, title "Steel Sedimentation Basin with an Internal Spiral Baffle."—Pittsburgh-Des Moines Steel Co., Neville Island P. O., Pittsburgh.

Skid Platforms—Bulletin No. 109, on steel-frame skid platforms for lift trucks.—Lyon Iron Works, Greene, N. Y.

Soldering Irons—Folder, on line of electric soldering irons.—The Stanley Rule and Level Plant, New Britain, Conn.

Steam Turbines—Bulletin 1179, covering line of automatic extraction turbine units.—Allis-Chalmers Mfg. Co., Milwaukee.

Steel Tubing—Folder, pointing out the importance of steel tubing to the aircraft industry.—Summerill Tubing Co., Bridgeport, Pa.

Switches—Bulletin No. 32-C, describing line of disconnecting switches and fuse mountings.—Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

Vacuum Pumps—Three bulletins: L-700-B1A, on type VV single and 2-stage vertical; L-711-B2, on belt-driven and steam-driven, single and 2-stage horizontal; W-711-B3, on types AE and AF horizontal simplex.—Worthington Pump and Machinery Corp., Harrison, N. J.

Valves—Catalog, covering line of valves, guides, springs, keys, shackles, bushings, etc.—The Toledo Steel Products Co. Toledo.

Valves—Reprint, title "A Valve in the Making."—Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.

Ventilation—Bulletin V-100-B, on building ventilation.—The Swartwout Co., 18511 Euclid Ave., Cleveland.

Vibrating Screens—Catalog No. 1562, on two types of vibrating screens.—Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia.

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ON THE CALENDAR

OCTOBER

5-9, National Safety Congress and Exposition, Atlantic City. W. H. Cameron, Managing Director, National Safety Council, 30 N. Wacker Drive, Chicago.

5-10, Fourth Annual Industrial Materials Exhibit, New York. Don Massen, Bakelite Corporation, 247 Park Ave., New York.

19-23, National Metal Congress and Exposition, Cleveland. W. H. Eisenman, National Secretary, American Society for Metals, 7016 Euclid Ave., Cleveland.

19-23, Seventeenth Annual Meeting, American Welding Society, Hotel Cleveland, Cleveland.

NOVEMBER

18-20, National Foreign Trade Convention, Chicago. James A. Farrell, Chairman. National Foreign Trade Council, 26 Beaver St., New York.

18-20, Thirty-Seventh Annual Convention, International Acetylene Association, St. Louis, H. F. Reinhard, Secretary, 30 East 42d St., New York.

30-December 4, Annual Meeting, American Society of Mechanical Engineers, New York, C. E. Davies, Secretary, 29 West 39th St., New York.

30-December 5, Twelfth National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.

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THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Tell the Employee and Tell Him Why

(Continued from page 40)

the various elements surrounding each situation affecting their personal well-being. Companies are like people. You have complete confidence and respect for certain men because over a period of time they have shown a sincere desire to live right. The industrial employee is intelligent. He quickly arrives at a decision as to whether he has confidence in his company. He forms his opinion largely by his own treatment or by the treatment of fellow employees. All decisions obviously cannot be in favor of the employee any more than they can all be against him. I have heard but few complaints from the men, when decisions were rendered contrary to their wishes, provided they were given all the facts and were told why that particular decision was necessary. On the other hand, problems of very minor consequence that were not explained and discussed have resulted in bruised feelings.

In a large corporation there are hundreds of people making decisions that affect people directly or indirectly. Unless there is some consistency in those decisions, unless those in a supervisory capacity thoroughly understand the aims and ideals of the management, there is apt to be inconsistent application of policies, and the result will be misunderstanding. To avoid this condition, ARMCO published its policies and distributed them to the organization some 17 years ago. Every employee representative is given a copy upon election, and every new man is handed one when his name goes on our payrolls. Thus they serve not only as a guide post for those who make decisions, but they also set up standards of treatment expected by the men. They are written in terms that are inherently broad rather than narrowly specific.

ARMCO'S Policies

We cannot insert all the policies here. After all, they constitute a respectably large booklet. However, by cutting them to the marrow, we can quote some of the more important relating to organization and people:

1. To insist upon a square deal always to everyone. . . .

2. To provide not only fair remuneration, but the best compensation for service rendered that it is possible to pay under the changing economic, commercial, and other competitive conditions that exist from time to time. It is ARMCO's ambition to develop an organization of such spirit, loyalty, and efficiency that can and will secure results which will make it possible for individual members to earn and receive better compensation than would be possible if performing a similar service in other fields of effort.

3. To provide every possible and practical sound incentive to best effort. . . .

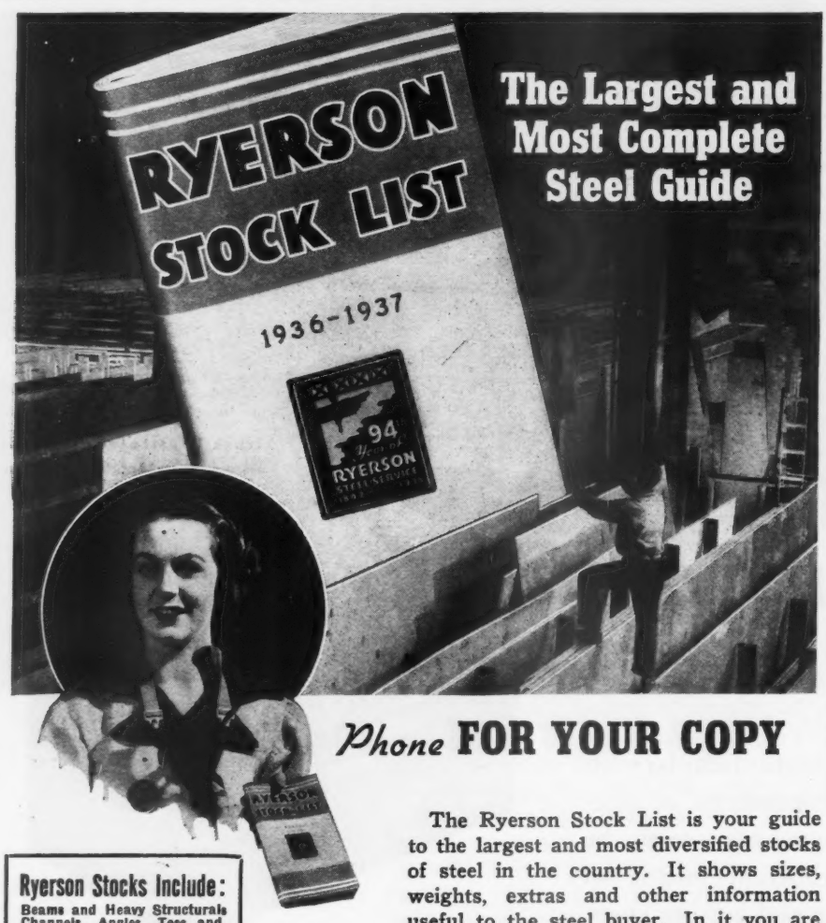
4. To provide every possible opportunity for advancement. . . .

5. To create and maintain both good and safe working conditions. . . .

6. In every way possible to encourage good living conditions. . . .

7. Through the operation of an employee representation plan, a measure of understanding has and always will be developed that will result in real cooperation between management and the organization at large.

How can broad general policies be enforced? The editors have asked me to emphasize that point. In the first place, the general management realizes that the application of policies is its own definite and specific responsibility. Any compromise would fatally undermine organization confidence in them, and our policies would become merely a



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Ryerson Stocks Include:
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Strip Steel, Flat Wire, Etc.
Stainless Steel
Hot Rolled Bars—Hoops and Bands
Cold Finished Shafting and Screw Stock
Extra Wide Cold Finished Flats
Alloy Steels—Tool Steels
Heat Treated Alloy Steel Bars
Boiler Tubes and Fittings
Welding Rod—Mechanical Tubing
Rivets, Bolts, Nuts, Washers, Etc.
Reinforcing Bars
Babbitt Metal and Solder

The Ryerson Stock List is your guide to the largest and most diversified stocks of steel in the country. It shows sizes, weights, extras and other information useful to the steel buyer. In it you are sure to find the kind and quality of material best suited to your needs. And the Ryerson organization will cut, form or do whatever is required and deliver the steel or allied products in record time.

Ten separate books show the local stocks in each of the ten Ryerson plants. If you do not have the current edition, phone or write us. We will be glad to send it to you.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cleveland, Detroit, Cincinnati, Buffalo, Boston, Philadelphia, Jersey City

RYERSON

lot of high-sounding words and phrases.

Every supervisor has it impressed upon him on every occasion that these policies represent the official position of the company. If he makes a decision contrary to the spirit of the policy involved, the company will not uphold him. Every workman is told that if his treatment does not measure up to what ARMCO policies lead him to expect, he has the privilege of appealing his case to each succeeding ranking supervisor until, if necessary, he reaches the president of the company.

The editors have also asked me to present actual illustrations showing how ARMCO policies have applied. Let us consider the plank in our industrial platform that states our intention to compensate the employee fairly and generously within our continuing ability to pay. If we are to live up to this policy, our personal relations department must constantly be informed on wage rates paid by competitors, or on similar work in other industries. We must be in position to discuss intelligently any wage problem that may arise. This involves a constant study of wage rates and earnings.

A "Fair Wage" Plan

Operating several plants in a number of states, as we do, we must be sure that we are compensating all men on jobs requiring similar skill and responsibility alike, taking into consideration if necessary the cost of living locally. Having acquired several plants and having inherited the wage scales existing in each, we determined to revise our entire rate schedule on a uniform basis.

After more than three years of research, during which time we studied, analyzed, and classified thousands of jobs in every plant according to the skill and responsibility required of the incumbent, we announced our "fair wage" plan in 1932*. But before any job was finally classified, first the foremen and then the departmental employee representatives were asked to express their opinion. Not until all had agreed were the jobs zoned and rates established.

Every man with a spark of ambition looks forward to the opportunity of getting a better job. We recognize this fact, and for that reason promote from within the organization. More than that, we feel that it is our responsibility to provide the necessary training facilities that will enable an ambitious man to qualify for a better job. Not only does this result in a stable organization, but our organization is also supervised and directed entirely by men who are trained in ARMCO methods and policies.

Those planks that deal with the establishment and maintenance of safe and satisfactory working conditions or with good living conditions are self-evident. None of us can do our best work unless we are provided with good tools and with safe and comfortable working conditions. Nor can we think straightest and enjoy life to the utmost unless we live in a good environment. We have tried to make our plants correspond with those ideals, and have never hesitated to do our share in the development of those things that make a community a good place in which to live and rear a family.

I should like to say, just as emphatically as I can, that in no instance has the ARMCO management been guided by philanthropic motives in establishing or applying any policy. We honestly believe that under the right conditions men do better work and more work, and we know they derive a great deal more

* What Is Skill Worth? H. H. Tullis, *Factory & Industrial Management*, Nov., 1931.

Important telephone orders are so easily misunderstood—serious errors are so readily made when mill noises interfere with telephone service. Such interference can be eliminated with the Burgess Acoustic Communication Booth, a remarkable doorless booth lined with a sound absorbent that blots up noise and produces a zone of quiet in the booth.

A Burgess Booth user says "Telephone conversations can be transmitted from Burgess Booths in our noisy departments more successfully than from telephones in departments devoid of noise. Our investment in Burgess Booths is well worth while." Investigate the Burgess Booth—mail the coupon for Bulletin 126. Learn how factory phone service may be improved.

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Say! I can hear fine in this
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Please send bulletin and prices on Burgess Acoustic Communication Booth.

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satisfaction out of their employment than otherwise. That is our philosophy.

How do the men respond? During the busy years in which our company has expanded from 250 men to 12,000 men, I cannot recall a single instance where any group of men has failed to do its part. On the other hand, our company throughout its existence has maintained a constant program of product and process development, and there have been countless instances where ARMCO men have accomplished the seemingly impossible.

A more recent and practical illustration of profitable cooperation lies before me on my desk. Last month one of our major plants attained a cost efficiency, based upon previously determined standards, of 100 per cent—and those standards were not loosely set. Two of our other larger plants were only slightly below par.

It has always seemed to me that the building of understanding should extend beyond the gates of the plant. In every community there is a large group of business and professional people. Their business is in large measure dependent upon industry. To them the industrial plant on the outskirts of the community, with a high fence around it and a watchman at the gate, is apt to be a deep dark mystery from which all sorts of mysterious rumors emanate from time to time. This statement is prompted by experience, not theory.

Several years ago we began to write a series of articles on subjects of current economic importance for our employees' newspaper. These articles were reprinted and mailed to the teachers, preachers, priests, merchants, doctors, and other business and professional people in every community in which we operate. Hundreds of letters have come to us from business people who state they have a much better understanding of their relationship to industry and of industry's problems in general. They have also given in more tangible ways concrete evidence that they do understand.

Every industry faces different problems. Every company has a different personality. Every management has different characteristics. We cannot be expected to see alike. However, under the American economic system of free enterprise there are certain fundamentals upon which we can all agree. One of these is that wages come from production. Therefore the more production, not only in the aggregate but per man, the more of the fruits of production available for distribution.

When there is cooperation and understanding, when all members of the organization work together harmoniously, there are bound to be more of the fruits of production available. When there is misunderstanding and discord, production is bound to suffer and there will be less to distribute. Bringing about a condition of understanding where all the members of an industrial organization can be kept informed regarding problems affecting the business and their own personal welfare is, in my opinion, the major task of management. It is a responsibility that is materially profitable to all. And I sincerely believe that the efficiency with which we perform that task is the real measure of our effectiveness as managers.

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● A PROLONGED HIGH-SPEED RUN! Any interruption ... any shutdown ... may perhaps mean an entire production schedule shot. Back a few years, you might have had cause to worry. But now, any machine can be equipped with the modern BIJUR AUTOMATIC LUBRICATING SYSTEM. Each bearing kept bathed in its correct oil film ... continuously ... automatically. With BIJUR installed, your mind is free. Lubrication troubles automatically dismissed!
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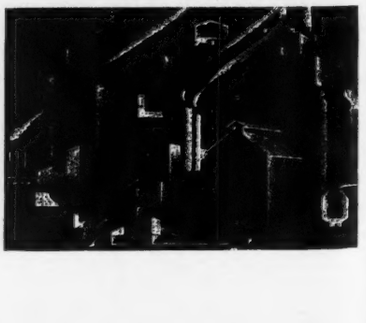


How the Courts View the Labor Act

(Continued from page 41)

is designed to be used in interstate commerce—for instance, a locomotive—or otherwise.

Another case involving the scope of the act is the case of the National Labor Relations Board *vs.* Friedman-Harry Marks Clothing Company, Inc., decided in the U. S. Circuit Court of Appeals, Second Circuit, on July 13, 1936. In that case the board petitioned the court for the enforcement of an order directing the company, a clothing manufacturer, to desist from certain unfair labor practices in discharging and discriminating against employees engaged in union activities. The court held that the orders of the board were unenforcible because the practices complained of were not in interstate commerce, did not directly affect interstate commerce, and therefore were not within the scope of the act.

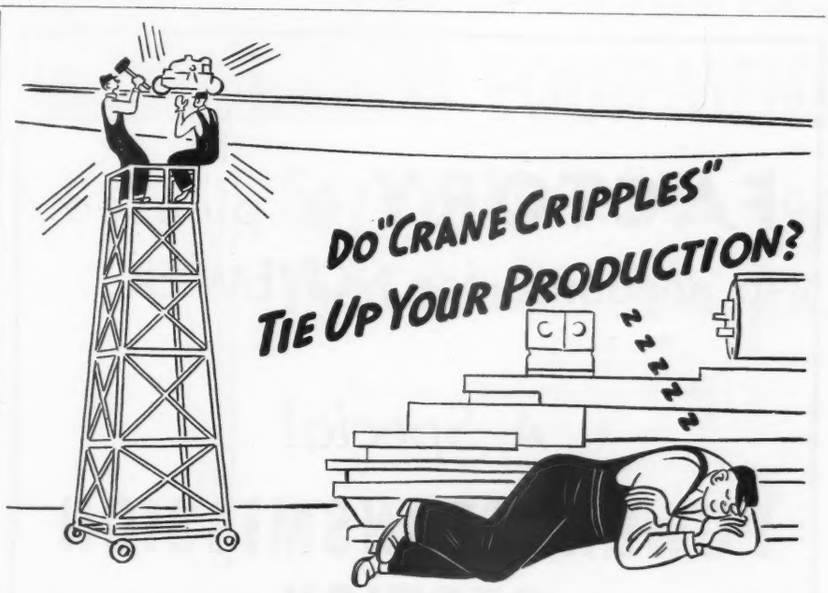
Not Interstate Commerce

In this particular case the government argued that raw materials used in the manufacture of clothing were shipped to the company in interstate commerce; that the manufactured clothing was later shipped in interstate commerce, and that the intermediate step of fabricating the clothing was but one of a continuous step in the flow of commerce; that therefore under the "flow of commerce" doctrine enunciated in the Swift Packing Company case, decided some years ago by the U. S. Supreme Court, this brought the particular process of manufacture within the field of interstate commerce. The court rejected this theory as applied to the manufacture of clothing from raw materials.

In the Swift case, where livestock was consigned and delivered to the stockyards, not as a place of final destination, but as a "throat through which the current flows," it was held that the activities at the stockyards were in interstate commerce. It is obvious that if the court had in the Friedman-Harry Marks Company case applied the "flow of commerce" principle, the activities of any companies engaged in the fabrication or processing of goods from raw materials designed for interstate shipment would be considered as coming within the act on the theory that fabrication or processing is a mere step in the flow of commerce. The decision in the Friedman-Harry Marks case seems definitely to shut off any chance of expanding the "flow of commerce" principle to take in manufacturing and processing.

In one case the National Labor Relations Board has scored a rather notable victory—the case of the Associated Press, decided by the U. S. Circuit Court of Appeals for the Seventh Circuit on July 13, 1936. In that case the board petitioned the court to enforce an order issued pursuant to the act. The board had ordered the reinstatement of one Watson, who had allegedly been discharged because of his membership and activity in the American Newspaper Guild.

Watson was employed in an editorial capacity as a member of the news department. He was engaged in the revision or rewriting of news coming in over the wires prior to its distribution and filing as outgoing news. The Associated Press contended among other things that Watson was not engaged in interstate commerce or in any activity directly affecting interstate commerce, and therefore the act did not apply. The court rejected this theory and held



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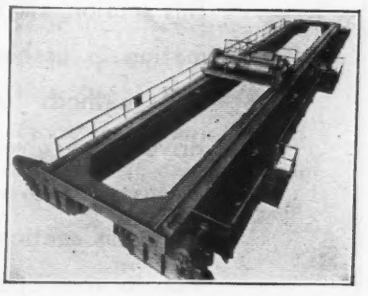

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that the business of gathering and distributing news is interstate commerce, that furthermore a labor dispute affecting the rewriting staff might cut off interstate and foreign receipt and transmission of news. The court therefore held that Watson should be reinstated.

This decision adopts the principle of "flow of commerce." However, the Associated Press case is clearly distinguishable from the Friedman-Harry Marks case in that the transmission of news through the medium of an agency such as the Associated Press is an activity in interstate commerce. The rewriting of such news is one in a series of continuous steps in the distribution of the news, but in the manufacture of clothing the manufacturing operation is entirely separate from the movement of raw materials and shipment of finished product.

May Affect Salesmen

If the Associated Press decision is sustained by the Supreme Court, it would seem that the act could be applied to any activities bearing upon the transportation of goods or intelligence, such as the activities of salesmen selling goods for shipment in interstate commerce, the activities of those in the shipping departments of companies selling goods for shipment in interstate commerce, and possibly the activities of editors of newspapers and magazines. Nevertheless, the scope of the act would be rather restricted, and it is doubtful whether its continuance would be justified. The decision in the Associated Press case upholds constitutionality of the act.

Two cases in the U. S. Circuit Court of Appeals involving the question as to whether a majority vote of all eligible employees in a particular craft is necessary, or whether merely a majority of those voting is necessary in a labor election, hold that a mere majority of those voting is sufficient.

Majority of Those Voting

The cases in question are those of the Virginia Railway Company, decided on June 18, 1936, by the U. S Circuit Court of Appeals, Fourth Circuit, and the case of the Association of Clerical Employees of the Atcheson Topeka & Santa Fe Railway System *vs.* the Brotherhood of Railway and Steamship Clerks, etc., decided in the U. S. Circuit Court of Appeals for the Seventh Circuit on July 8, 1936. It should be noted, however, that these cases are under the Railway Labor Act. The language in the Railway Labor Act governing this question is as follows:

> The majority of any craft or class employees shall have the right to determine who shall be the representative of the craft or class for the purposes of this "chapter."

The National Labor Relations Act provides as follows:

> Representatives designated or selected for the purposes of collective bargaining by the majority of the employees in a unit appropriate for such purposes, shall be the exclusive representatives of all the employees in such unit for the purposes of collective bargaining in respect to rates of pay, wages, hours of employment, or other conditions of employment.

As the language used in the two acts is not essentially different so far as the particular question is concerned, it is likely that courts which have ruled in the cases involving the Railway Labor Act would rule similarly on this question in a case involving the National Labor Relations Act.

Several decisions have been rendered by the U. S. Circuit Court of Appeals in cases involving the question as to whether an injunction may be obtained to restrain the Na-

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tional Labor Relations Board from investigating complaints, holding hearings on complaints, and taking other preliminary steps under the act. The decisions in these cases generally do not touch on the merits of the law but go to the question of the right to prevent the board from taking the preliminary steps it is authorized to take under the law. The courts hold with few exceptions that an injunction will not be issued, since the petitioner has a suitable remedy at law and is unable to show facts to support the contention that if the injunction were not issued the petitioner would suffer irreparable injury.

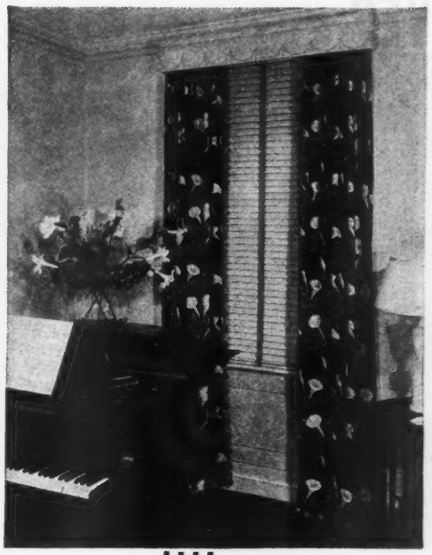
As these cases do not directly involve the constitutionality of the act or its applicability to the businesses of the various companies involved in the suit, it is not considered that the decisions are of great importance.

Summarized briefly, while there have been some important decisions under the act, no cases involving a substantial question have been passed upon by the United States Supreme Court. This is particularly true so far as the question of constitutionality is concerned. As a matter of fact, it is extremely difficult to glean from the decisions of the Circuit Court, with the possible exception of the Associated Press case, a definite and positive view on this question. It is fairly clear, however, that the scope of the act will be restricted to those activities that are essentially interstate commerce in nature, or directly affect interstate commerce, and that it will not be applied to production or manufacturing processes. It also seems clear that certain activities within organizations engaged in production or manufacturing might be held to come within the act, such as those in shipping departments of concerns doing business in interstate commerce, traveling salesmen, editors of newspapers and magazines designed for interstate circulation, and operatives in related capacities.

Cost Fumbling or Cost Engineering?

(Continued from page 49)

with equal justice in industrial costing, it has never been given recognition. Each expense item incurred in the manufacture of product can be charged to the products benefitted as accurately and as readily



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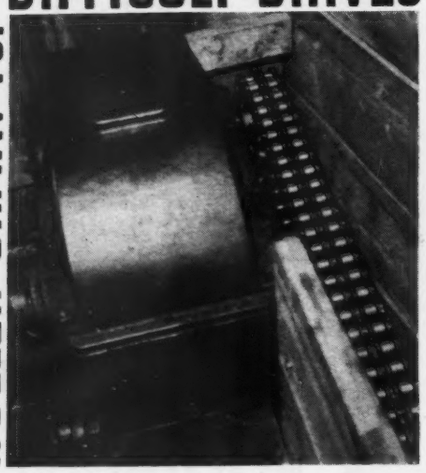

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The Baldwin-Duckworth line offers roller chain of all types and sizes and accurate cut tooth sprockets. For most satisfactory service use these two Baldwin-Duckworth products together. Send for copy of catalog. Baldwin-Duckworth Chain Corporation, Springfield, Mass.

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as the corner grocer charges his customers with pounds of sugar, bushels of potatoes, or dozens of eggs.

5. *The chargeable hours and the expenses of two or more processing units can be combined and their unit costs averaged only when their expenses are in approximately uniform ratios and either unit of the group can be used for making identical products.* Processing units differ in many characteristics. They may be expensive or inexpensive, large or small, manually operated, power operated, automatic, active, static. They may depend upon the action or reaction of chemicals. Their activities may be occasional, intermittent, seasonal, or continuous, according to the nature of or the demand for their products. Again, processes may require highly skilled operators under rigid supervision and inspection. They may be so simple that they may be operated by unskilled workers with a minimum of risk of spoilage.

6. *Contingent expenses—spoilage, shrinkage, waste in cutting materials, losses on the sale of by products, losses due to changes of style or in demand, etc.—are legitimate cost factors, and should be included in cost calculations and properly allocated.* In human experience accidents do happen, mistakes will occur, and the wise manufacturer, while using every precaution to prevent their occurrence, must recognize their probability and anticipate the losses they will entail. Contingent expenses may be the result of carelessness or of unforeseen causes. Losses due to contingencies may be slight or they may be disastrous. A reasonable allowance, based upon experience, should be made to cover them.

For Accurate Pricing

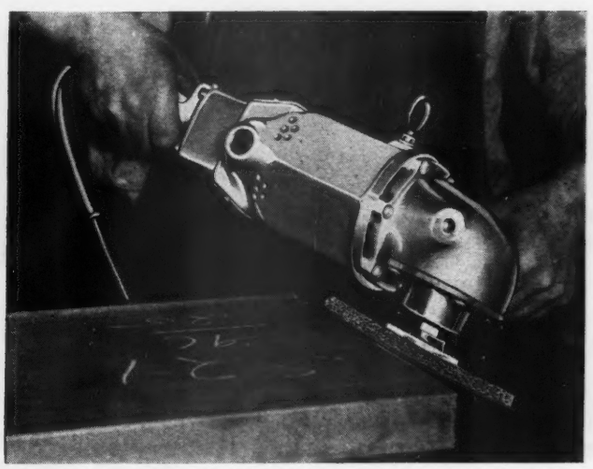
The foregoing six principles form a complete and practical basis for scientific industrial costing. They have been applied, and their use has proved exceptionally profitable in factories making products ranging from the automatic production of common pins to the building of paper-making machines. Their adoption and general use by American industrialists would, in a short time, eliminate the vagaries in pricing and the distrust of competitors that now comprise industry's greatest menace.

HAVE YOU discovered these ways to CUT COSTS?

CHECK over your production and maintenance operations—notice the time spent on slow, laborious hand work with sandpaper, emery, files and other abrasives—and you'll find plenty of opportunities to save time and cut costs with Black & Decker Electric Sanders. Or, better still, call in your Black & Decker jobber—learn about the new low prices on Black & Decker Sanders—and let him give you the benefit of his experience in helping others tool up to cut costs down. For complete catalog write to: The Black & Decker Mfg. Co., 719 Pennsylvania Ave., Towson, Md.

SANDING CASTINGS, smoothing casting ridges, preparing all types of metal and wood surfaces for painting or plating, are but a few of the hundreds of cost-cutting uses of Black & Decker Electric Sanders on both maintenance and production work.

GRINDING FLAT SURFACES, smoothing welds, etc., are quick operations with a Black & Decker Sander equipped with a "saucer" type grinding wheel. Sanders are also used with abrasive discs, cup grinding wheels, wire-brush wheels, felt rubbing pads polishing pads, and rotary planer heads.



REMOVING BURRS left by acetylene torch cuts in heavy metal, smoothing metal joints for perfect fit, preparing metal for welding, removing rust, paint and scale from wood and metal surfaces are a few more time and labor saving applications of Black & Decker Sanders.

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RECOVERY OF MATERIAL FROM THE AIR—successfully and profitably achieved with Coppus Filters, in metal, chemical, food, soap, drug and other plants processing dry products.

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3327

Don't Leave Dollars in the Scrap Pile

(Continued from page 58)

its varied nature, is more difficult to handle. At the very least, steel and cast iron should be kept separate, and non-ferrous metals cleaned of all iron attachments before sorting. Salvage possibilities should not be neglected.

Dismantling operations yield scrap that often contains large quantities of usable equipment and many parts that can easily be reclaimed. Such items as shafting, belting and pulleys, pipes and pipe fittings, structural steel and plates are worth much more than scrap and are readily salable. It is common practice to cut up all good scrap pipe into nipples. One large machine tool builder employs a draftsman who checks up on all parts discarded as ruined or obsolete to see if they can be made useful in some other of the company's products.

So varied in nature are industrial scrap materials that specific reference to particular items and ways of handling them could be continued indefinitely. For instance, scrap high-speed steel is worth about 15c a pound, and can be told from tool or carbon steels by holding it against a grindstone and noting the character of the spark stream. The tungsten in the high-speed steel will give the sparks a dull red color.

Three Sales Methods

Scrap can be sold at auction, by sealed bids, or on a sliding scale contract based on trade paper quotations. Of the three methods, sealed bids are generally preferable in spite of the office work resulting. If the auction method is used, it is too easy for a group of bidders to reach an agreement beforehand and manipulate the bidding so that there are spoils for all. Dealers like the sealed bid because it prevents their competitors from knowing what prices they are quoting, an important consideration when their aim is speculation, as it often is. The sliding scale contract based on trade paper quotations works well when the market is firm or rising, but sometimes leads to difficulties at times of low prices and a stagnant market. It is to be noted that the sealed bid is the method commonly employed by the railroads, which generally get top prices.

Whenever possible, scrap should be

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* E. P., elephant power, meaning big horsepower as with large turbines.

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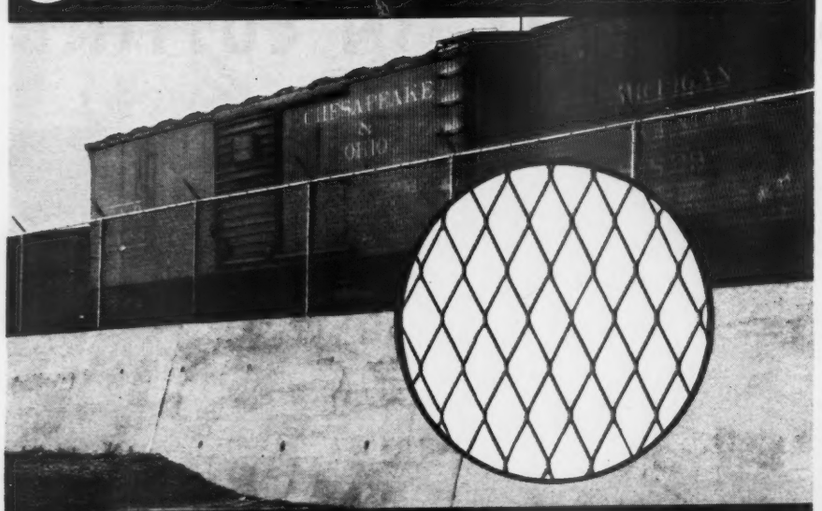

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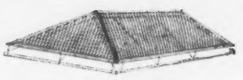

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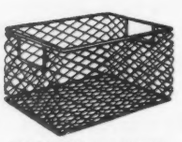

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sold in as large quantities as storage facilities permit. Otherwise the cost of storage falls on the dealer, who will make an allowance for this cost in giving his price. It has been argued that industrial concerns should hold material for speculation, but in my opinion this is not a wise practice for an organization that is not primarily engaged in trading in waste materials. The antics of the scrap market are sometimes more than even the dealers can understand.

The summary boils down to this: Know the value of what you are selling. Prepare it so that it is worth most to the buyer. Know where and how to sell it. If, perhaps, some guides to action will prove helpful, the following rules may be laid down:

1. Prevent contamination at the source.
2. Grade and prepare material in accordance with the needs of the markets. If the material is light and bulky, like paper, keep in mind the buyer's handling costs while he is in your plant.
3. Salvage all materials that can be used again with profit, whether a wiping rag which, after washing, may be used again, or a machine part costing thousands of dollars.
4. Give all possible markets a chance to bid.
5. Cooperate with the scrap dealer. He will play square with you.

Thousands of Bearings to Lubricate

(Continued from page 60)

The lubricant is a straight mineral oil, having approximately the same characteristics as given under No. 4 system.

In designing these systems, primary consideration was given to tooth pressure, bearing loads, and the rubbing velocities to be encountered. Detailed calculations showed that in order to be assured of low bearing temperatures, it would be necessary to supply an adequate amount of lubricant for cooling as well as for lubrication. Calculations were made of the friction in both the lubricant pressure-feed and gravity drain lines, and allowance was made for considerable fluctuations in operating temperatures, due to atmospheric conditions.

Physical conditions limited the depth of the oil cellar in the hot strip

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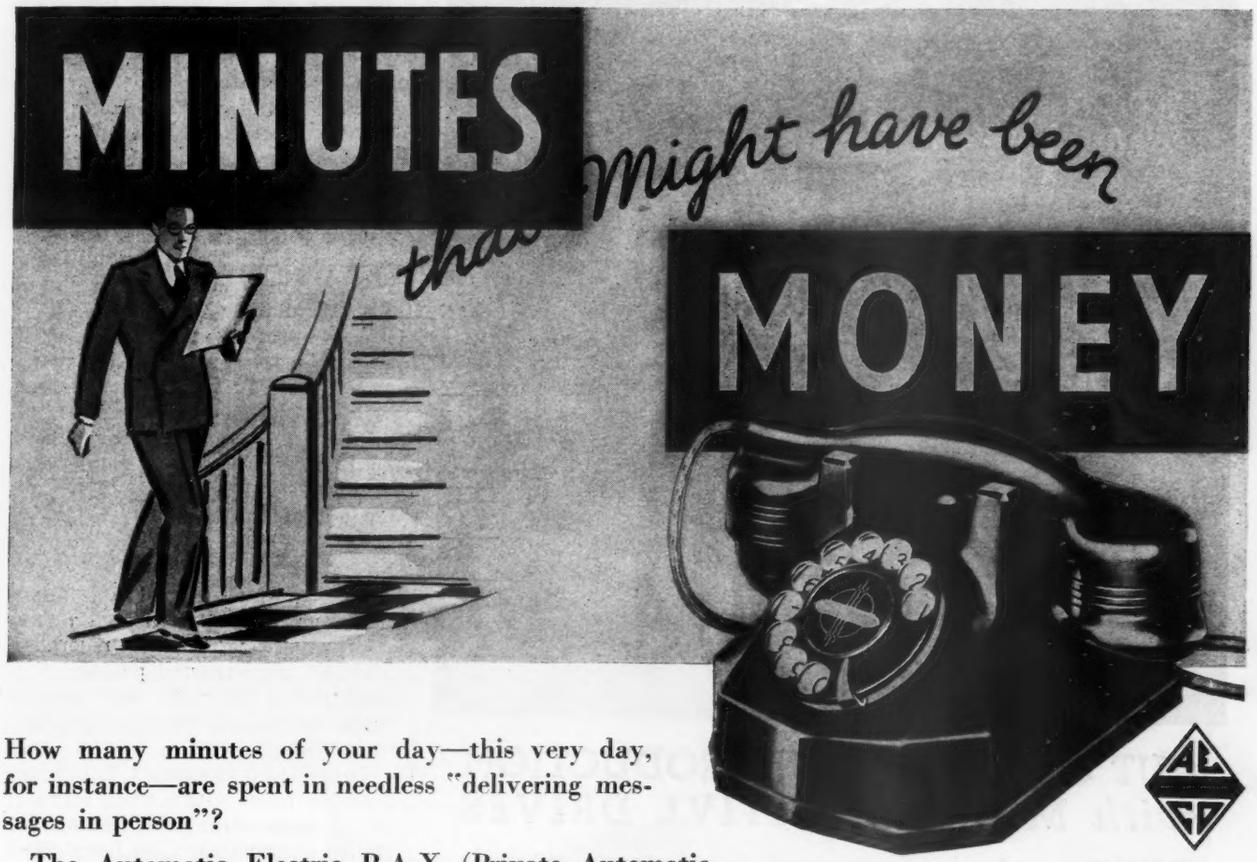

How many minutes of your day—this very day, for instance—are spent in needless "delivering messages in person"?

The Automatic Electric P-A-X (Private Automatic Exchange) would have saved this valuable time—would have reduced the effort of *going* to the mere twist of a dial and *talking.*

The P-A-X, too, would serve your entire organization in facilitating inter-departmental communications which otherwise would have to be sent by messenger or carried through your telephone switchboard, with lost time, added confusion, and wasted energy.

In use now in over 2,000 businesses, both large and small, this privately-owned automatic telephone system is contributing daily to the smooth, speedy, convenient routine of management—resulting in increased production at lower cost.

The P-A-X is built in a variety of sizes and types to meet every need. Our representative will be glad to give you full details of the type that will best serve your plant —with supporting data as to the economy it will produce. Write us or use the coupon for full information.

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- ***Convenient to Use*** — No push buttons; standard dial operation.
- ***Reduces Public Telephone Expense*** — Time of your switchboard staff is made available for other duties.
- ***Simple to Install***—Only two wires from each telephone to the P-A-X switchboard.
- ***Provides a Variety of Special Services*** — Including Code Call, Conference, Executive Right-of-Way, etc.

American Automatic Electric Sales Company,
Chicago, Illinois

☐ Send me your P-A-X Booklet, "The Voice of Modern Business."

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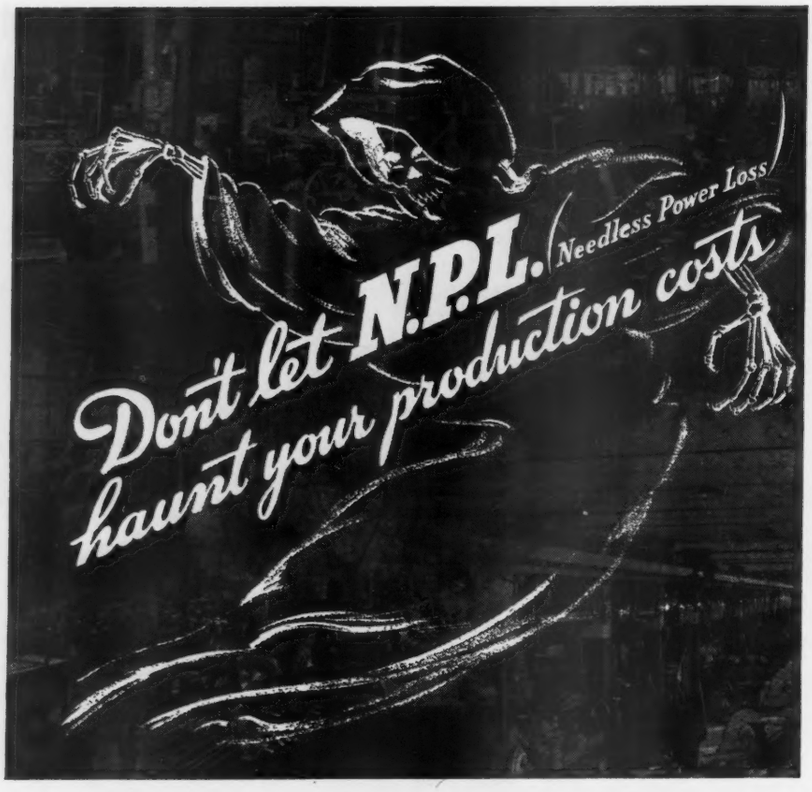

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PERHAPS *your* plant isn't losing any of the power produced by your motors. Perhaps *you* are having no trouble with slipping, inefficient fast-wearing drives. But . . .

Records show that 65% of all equipment in use today is more than ten years old. It's quite possible that Needless Power Losses *are* haunting your production costs and profit sheets. If so . . .

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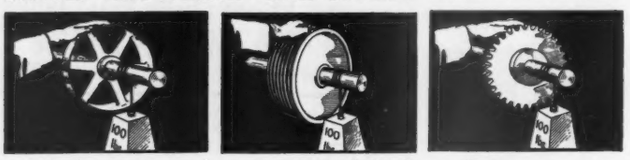

It is hard to get a good grip on a smooth-faced, or even a grooved wheel. But it is easy to grip and turn a toothed wheel. That's the sound principle behind Morse Positive Drives. Teeth, not tension—turn them. They cannot slip and waste power.

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mill to 19½ ft. below mill floor level, and the depth of the oil cellar in the cold strip mill to 17½ ft. In the hot strip mill the distance between the two extreme points requiring lubrication is approximately 417 ft., whereas in the cold strip mill it is 686 ft. Therefore, contrary to all previous practice, the oil cellar was extended underneath and beyond the center line of the mill proper, permitting an arrangement of the main oil reservoirs decidedly different from that used previously in a similar type of mill.

Main oil reservoirs are each 22 ft. long, 9½ ft. wide, 6½ ft. high, so installed that the length is at a right angle to the pass line of the mill proper. This arrangement permitted the reservoirs to be located directly under the pass line of the mill and out of the way.

Equipment Required

The two main circulating pumps are grouped symmetrically in front of their respective oil reservoirs. Thus an unobstructed passage, 7 ft. wide and 6 ft. high, was obtained from one end of the hot strip mill to the other.

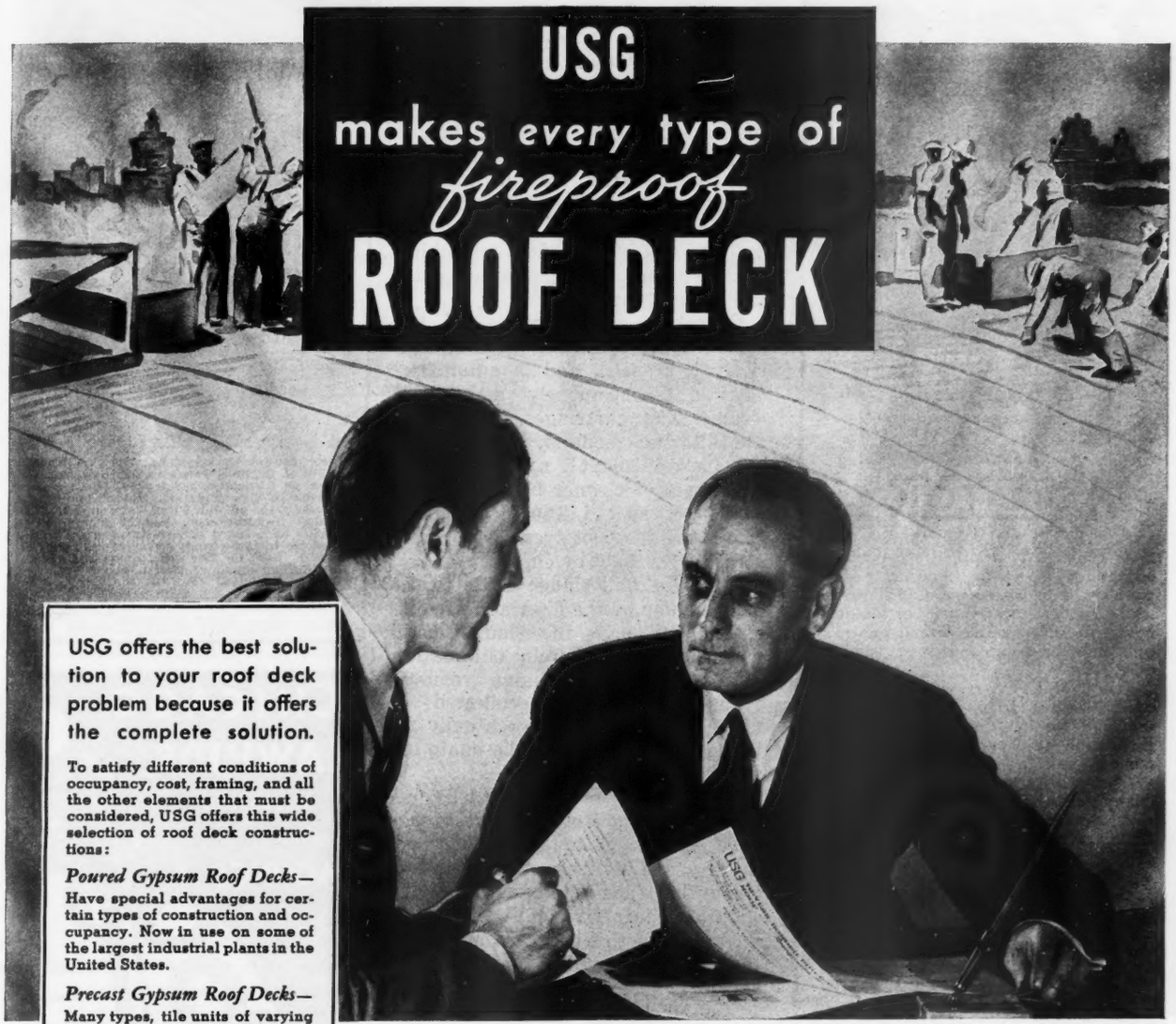
Lubrication systems 1, 2, 3, 5, and 6 are equipped with a main oil reservoir; main circulating pumps installed in duplicate; De Laval filtration equipment to handle 100 per cent of the oil flow down to the equivalent of a 90-90 mesh; pressure tank for surge protection and operation of pressure switches; oil cooler for the automatic control of lubricant temperatures; and a stationary installation of continuous bypass centrifugal oil purification equipment for the continuous removal of moisture, sludge, and other products of deterioration which cannot be removed by filters.

Systems 4 and 7 are provided with all of this equipment with the exception of a pressure filter. In the lubrication of ring-oiled bearings, with which all main motors and m.-g. sets are equipped, a centrifugal machine is more efficient than a filter for maintaining the lubricant in proper condition. It keeps the circulating lubricant in a dehydrated condition, with high dielectric strength, thereby eliminating stray currents across the bearings, which may cause pitting.

In general design all lubrication systems for the hot and cold strip mills are basically identical, the only outstanding difference being the variation in detail design resulting from the difference in the locations of the various pieces of equipment.

The systems employed for both the

YOU'LL GET UNPREJUDICED ADVICE FROM A USG ENGINEER BECAUSE . . . . .



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To satisfy different conditions of occupancy, cost, framing, and all the other elements that must be considered, USG offers this wide selection of roof deck constructions:

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Have special advantages for certain types of construction and occupancy. Now in use on some of the largest industrial plants in the United States.

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USG also manufactures roof insulation and Built Up Roofing. Here are the three elements of a roof—the deck, the insulation and the built up roofing. That is why we say "USG offers the best solution because it offers the complete solution."

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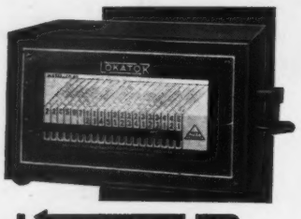

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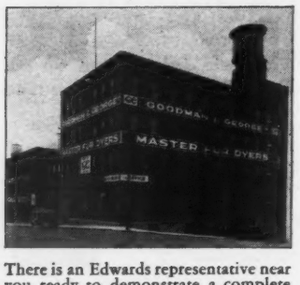

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EDWARDS and COMPANY INC.

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hot and cold strip mills are fully automatic and require a minimum of manual attention. All electrical controls are completely interlocked. Warning sirens give protection against failure of the lubricant supply.

Main oil reservoirs and pressure tanks are of all-welded construction, complete with baffles and thermostatically controlled heating coils.

All pumps are of the direct-driven type, having built-in relief valves, special sleeve-type bearings, flexible couplings, and herring-bone gears cut from a steel forging integral with the shaft. This type of pump has no timing gears and provides positive and smooth flow with high efficiency and a minimum of noise and moving parts.

Filtration equipment is of the rotary type, operating at comparatively low speed, and is automatically and continuously maintained clean. The cartridges, which are the filtering medium, revolve continuously at about 1 r.p.m. so that a double set of cleaner blades on each cartridge, spaced 180 deg. apart, combs the free slot area clean of any solids every half revolution.

Sediment and sludge settle to the sludge sump of the filter and are discharged through the sludge drain when necessary, thereby eliminating messy cleaning. Sludge removed from the filter is collected in filter drain tanks and eventually returned for re-use in the main oil reservoir.

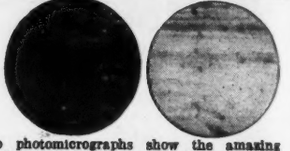
All oil coolers are specially designed, having rolled naval bronze tube sheets, seamless drawn admiralty metal tubes, steel shell, and removable tube bundles.

In a modern strip mill, more than 2,000 antifriction bearings on the mill machinery and tables require grease lubrication. The system of centralized grease lubrication used throughout the hot mill, cold mill, and pickling departments is one of the most complete and modern ever installed, and provides the necessary flexibility required. It may be likened to a city water system in which the water is pumped from a central pumping station through a system of pipes, individual consumers being supplied from the main lines through smaller pipes.

The mills proper are equipped with an automatic, electrically timed device which operates self-indicating, displacement-type grease valves located on the mill bearings that supply grease at regular predetermined intervals and in predetermined quantities. In addition, each battery of

(Continued on page 98)

Improved PYROIL



These two photomicrographs show the amazing ability of Improved Pyroil to stop damaging corrosion on frictionized metal parts. *Left:* a bearing run in high grade oil. *Right:* bearing run in same grade oil with Pyroil, only, added. Note freedom from corrosion—chemical attack! Pyroil supplies an oriented film—reduces surface tension—reduces friction—speeds operation—cuts costs all around. Send for Free facts, charts and material of distinct value. Mfrd. & Guartd. by Pyroil Co., W. V. Kidder, Founder, 197 LaFollette Ave., LaCrosse, Wis., U. S. A.

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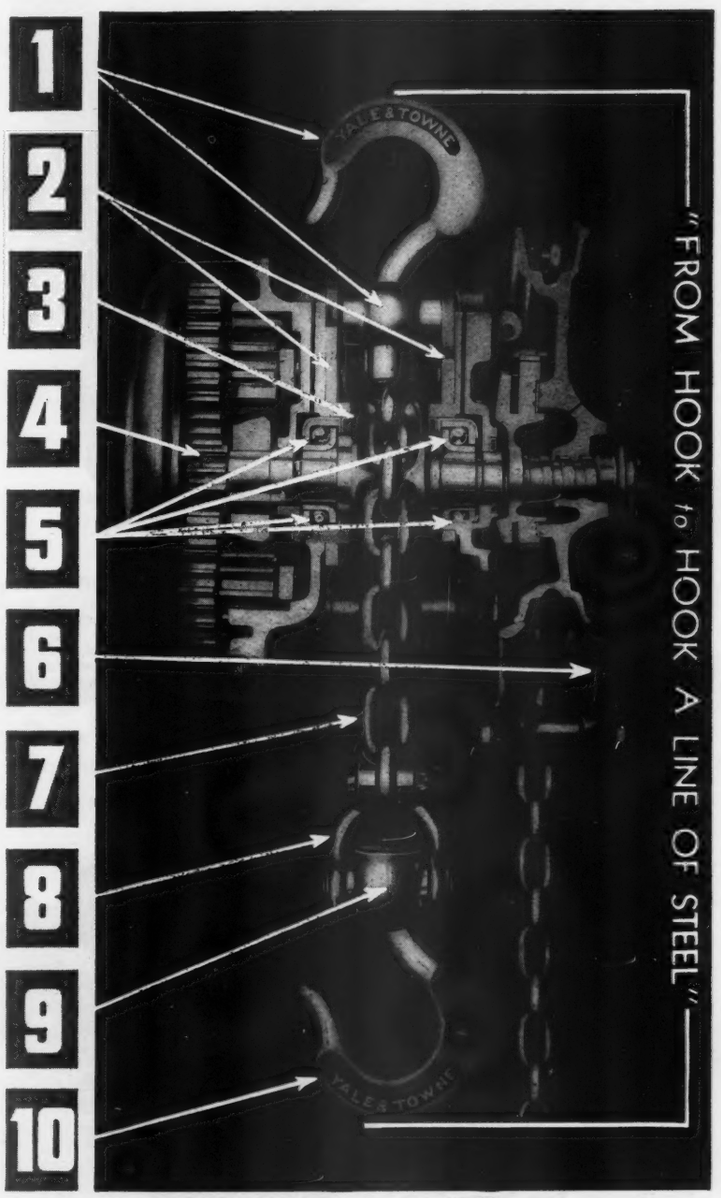
10 REASONS WHY BUYERS SELECT YALE CHAIN HOISTS

Because . . . Yale Chain Hoists have an international reputation for QUALITY and that quality is based on the outstanding features of construction, as follows:

1 Heavy forged steel safety hook and cross head designed to withstand shock.
2 Heavy wrought steel suspension plates support the load between the top hook cross head and load sheave.
3 The load sheave on which the load is lifted is a massive special analysis steel casting.
4 The driving pinion is a one-piece forging of special steel.
5 Ball bearings upon which the load sheave is mounted are of high carbon chrome alloy steel running in chrome vanadium steel races.
6 A continuous and adjustable hand chain guide prevents snagging—with a tensile strength of 50,000 lbs.
7 The load chain is of steel, welded and heat treated.
8 Drop forged two-piece shackles with heat-treated suspension pin permit changing or replacing load chain without welding.
9 Lower hook is equipped with heavy duty ball bearing, completely enclosed, packed in grease, requires no further lubrication.
10 Steel safety hook opens slowly without fracture before any other part of the hoist is overstrained—protects operator and load.



DISTRIBUTORS MAKE YALE HOISTING EQUIPMENT THE EASIEST TO BUY

The Yale Distributor is no further away from you than your telephone. The hundreds of Industrial Supply organizations who feature Yale Products cover the entire country. In every industrial center they are business leaders, serving industry swiftly, efficiently and economically. Yale Chain Hoists and allied equipment are sold only through Yale Distributors—in order to provide American industry with the fastest, most satisfactory kind of service.

Capacities 300 Lbs. to 40 Tons

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POWER SAVING—because they're all made by

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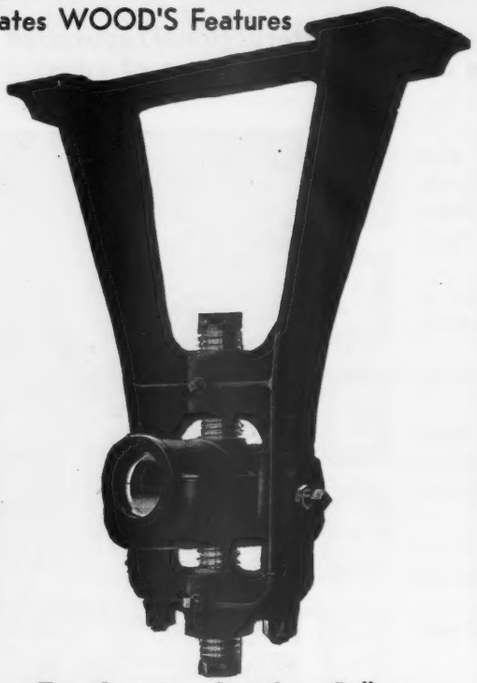
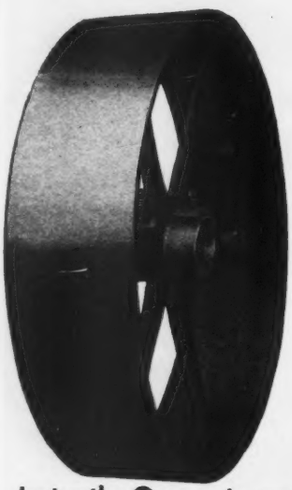
No Other Hanger Duplicates WOOD'S Features

WOOD'S HANGERS are the only hangers of the ball and socket type in which the bearing may be adjusted vertically and laterally within the frame without moving the plungers sidewise. This is but one of many features that make these hangers more economical in the cost of erection, maintenance and operation of shafting for the mechanical transmission of power.





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WOOD'S PULLEYS are made of Cast Iron because we have found through nearly 80 years' experience that Cast Iron Pulleys are superior to other types. Available in large and small sizes, split and solid, flanged, taper-cone, step-cone, tight and loose, wide and narrow, ball or metallic bearing . . . these pulleys are sturdy, dependable, accurately balanced and true-running . . . WOOD'S Quality throughout.

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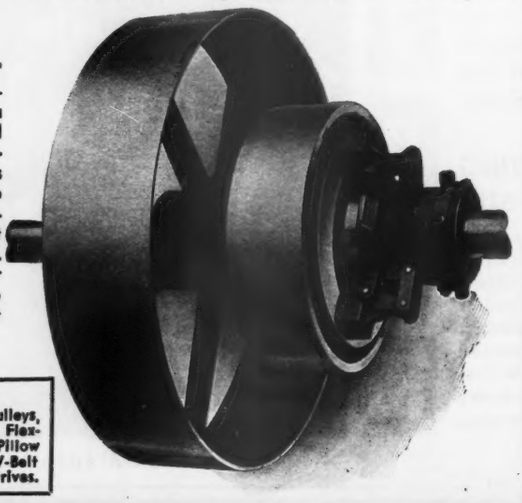
The WOOD'S "PEERLESS" UNIT ADJUSTING FRICTION CLUTCH enables you to control your developed power as you do your automobile . . . as easily and as quickly. With it, any single machine, or an entire battery can be cut in or out at the will of the operator. And all adjustments (for wear or load) may be made at one point—and without special tools.



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MEMBER: The Mechanical Power Engineering Associates.

(Continued from page 92)

valves on the mill housings is equipped with pushbutton control so that additional grease can be supplied to certain bearings, if desired.

Bearings that require lubrication at infrequent intervals are equipped with hand-operated trippers, which receive grease from the main pressure pipes and feed it through the indicating valves to the bearings. This system is employed on isolated machinery, such as mill tables and individual machines in the pickling department.

Advantages of a system of this type are positive application of grease to the bearings in the exact quantity required to suit each bearing, at proper time intervals, thus insuring trouble-free operation with a minimum amount of labor.

The grease pumps are designed to maintain a line pressure of 5,000 lb. per sq.in. Each of the four pumps is located at a convenient point and is a self-contained unit equipped with a special barrel-handling device which permits one man to handle the storage and pumping of grease. They are of the double-acting-piston type, so arranged that repairs can be made to either set of pistons without interfering with the operation of the other, thereby insuring uninterrupted service.

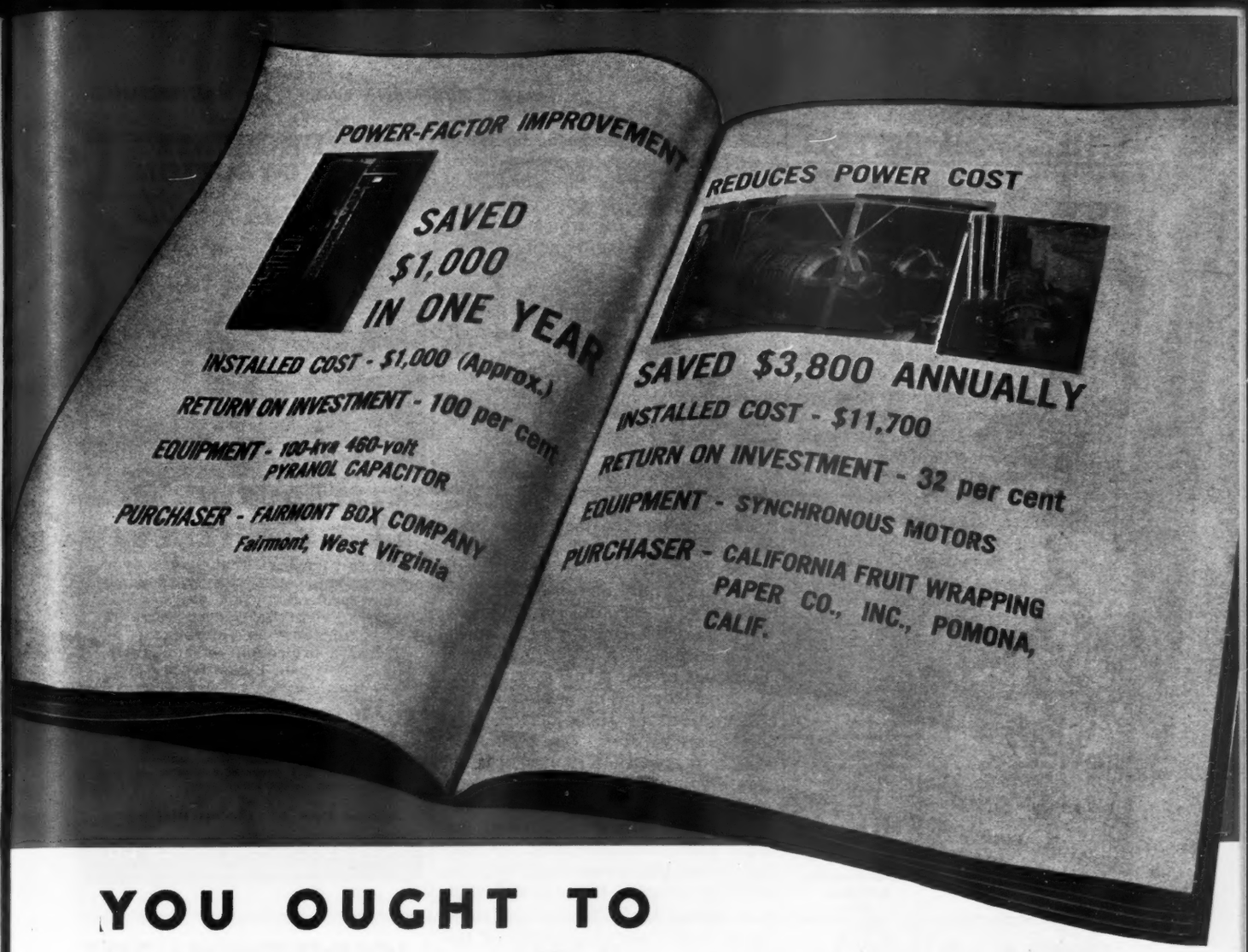
Time and Circuit Control

(Continued from page 62)

circuits is found in the plastics industry. Molding of plastic compounds into many different products requires that they be left in the steam-heated mold for some minutes so that they may be properly cured. The elapsed-time switch signals the end of the curing time audibly or visually, or may be arranged to open the mold and remove the product.

Thus in these three general forms does the partnership of time and the control of electric circuits serve industry. Those who have been active in the application of time switches have repeatedly found time measurement, a corollary subject, also of value.

Measurement of time may show the total minutes' duration of one or several elapsed periods, or perhaps the total elapsed time with reference to particular events or processes. This measurement is often accomplished by a simple device that counts minutes, tenths of hours, or hours. It is operated automatically by connecting it to the circuit that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THERE are hundreds of cases on record of substantial savings in power costs made by the installation of G-E power-factor-improvement equipment. If your power contract includes a power-factor adjustment or kva demand clause, you may be missing an opportunity to reduce power costs. In addition, power-factor improvement will improve plant operation. We shall welcome an opportunity to discuss this matter with you and make recommendations for the proper equipment. Write the nearest G-E office, or General Electric, Schenectady, New York.

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GET-541	GEA-77J
( )	( )

Send me your bulletins "Direct Reading Power-factor Improvement Chart," GET-541, and "Improving Power-factor for Profit," GEA-77J as checked above.

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G-E Pyranol capacitors will help you improve power-factor. Pyranol is General Electric's remarkable noninflammable, nonexplosive liquid dielectric. Used in G-E capacitors it provides the maximum degree of safety; permits units of smaller size—saving you space; and assures dependable operation—the service record of G-E Pyranol capacitors is 99.83 per cent perfect. Specify G-E Pyranol capacitors.

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WHEN YOU INSTALL

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counts minutes, tenths of hours, or hours. It is operated automatically by connecting it to the circuit that supplies electric service to the process or function for which it is desired to record the minutes of operation.

One of the typical applications of such time meters in industry is that of directly measuring machine utilization. All plant operators are interested in keeping machine tool investment at some optimum value. The time meter affords a direct measure of machine utilization, or "utilization efficiency." Such measurement helps to guide management in its investment of capital, whether it be in production machinery or in the more highly specialized machines of the toolroom.

In addition to this service the time meter may in certain cases be an excellent measure not only of the utilization efficiency of a particular machine, but of the actual efficiency of the operator. For example, the measurement of time has been applied to arc welding. One time meter is so arranged that it measures the time during which electrical energy is delivered to the arc welding set. Here, in effect is a measure of machine utilization efficiency. A second meter totals the time that the machine actually is welding. This is a measure of the operator's efficiency in the use of the welding machine.

Obviously, such records are of great value to many shops that regularly use arc welding as an important process in the manufacture of their products.

Induction Motor Maintenance

(Continued from page 64)

The copper rings may be made by heating a copper bar of the required cross-section to a cherry red. When it has cooled off, roll it into the shape of a ring around a pulley of the required size, as in Figure 4. A butt joint should be made, the ring tapped into place inside the circle of rotor bars, and the rotor brazed.

Afterward the edges of the rings should be trued up in the lathe and the rotor balanced by bolting lead weights to the spider.

When removing or re-installing the rotor in a stator, great care should be exercised not to let the

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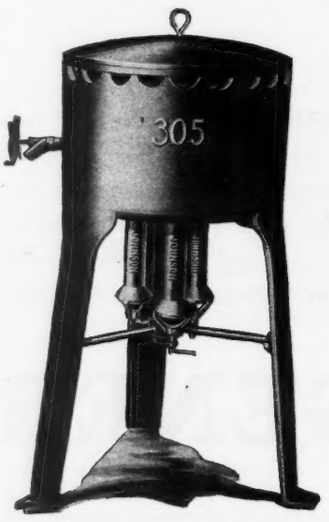

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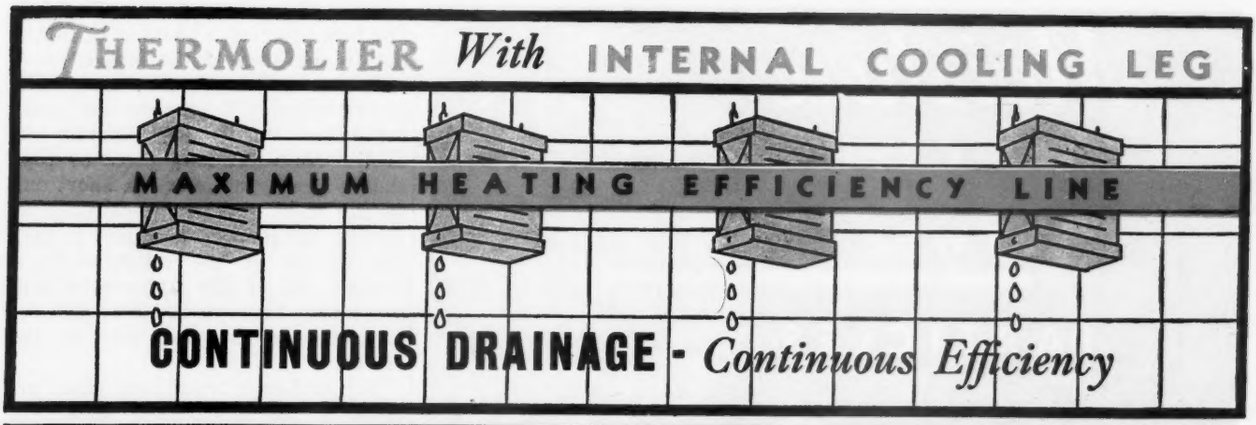

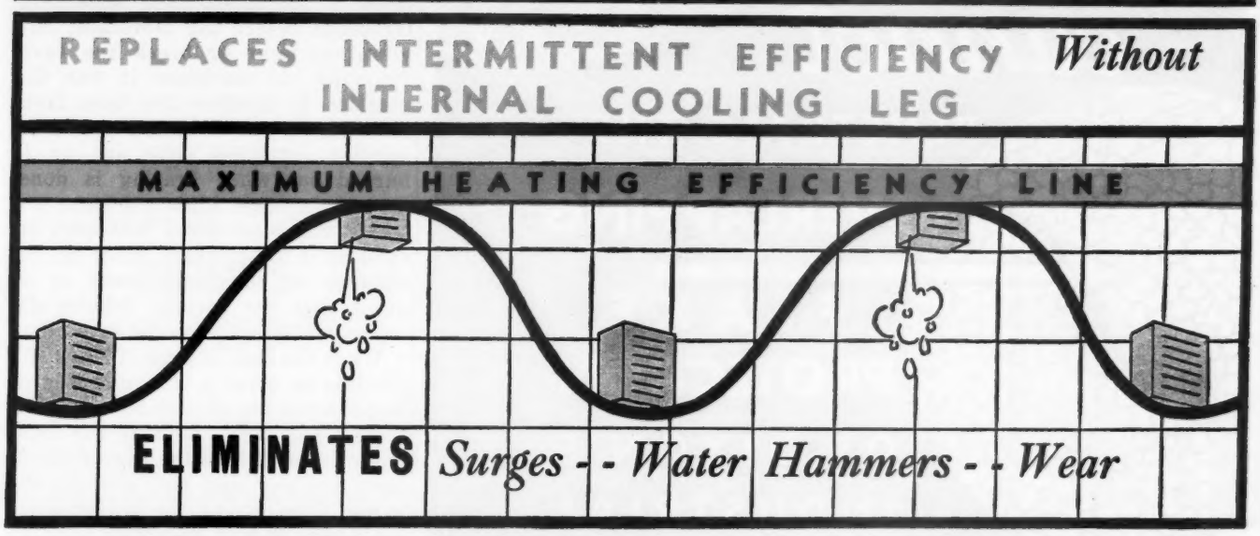
REPLACES INTERMITTENT EFFICIENCY Without INTERNAL COOLING LEG
MAXIMUM HEATING EFFICIENCY LINE
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CONTINUOUS DRAINAGE OF "LAZY WATER" FROM THERMOLIER

You know what the pounding of a water-hammer or surges can do to pipe and fittings. Grinnell has provided continuous drainage of "Lazy Water" from the Thermolier — to prevent strains on the heater and trap — to keep heating efficiency at a steady, constant high.

When you choose Unit Heaters, remember that Thermolier is the *only* one in which provision is made for continuous collection and disposal of condensation — "lazy water" — within the heater.

To you, this is sure to bring two definite advantages. First, more heat per dollar. Second, far longer life and lower cost per year. Write today for the Thermolier Data Book.

GRINNELL COMPANY
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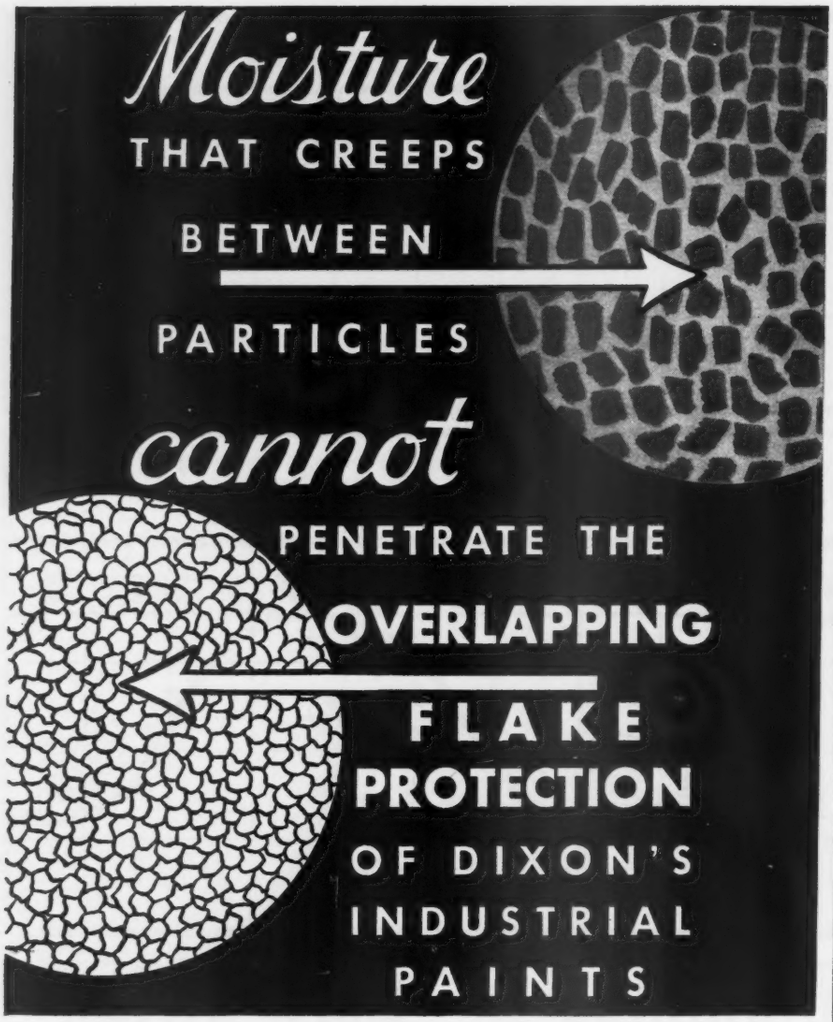
GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY



A COAT of paint must be one of two things: A glomeration of pigment particles held in place by the vehicle—or a coat of thin, flat microscopic flakes overlapping one another like minute scales. Reason will tell you which is best for excluding moisture and fumes. Records extending over nearly a century prove that the overlapping flake protection of natural silica graphite, as used in pure boiled linseed oil for Dixon's Industrial Paints, protects at lowest cost per square foot-year. Water repellent and chemically inert, flake graphite is the ideal industrial paint pigment.

The architects and engineers for the Chicago Clearing Industrial District always specify that steel shall be painted with a gray graphite paint before delivery and consider gray graphite an excellent base for aluminum paint.

To cut the cost of painting *and the still higher cost of NOT painting*, specify and use Dixon's Industrial Paints. They are available in fourteen colors including aluminum. Write for Master Specifications B1-44.

Paint Sales Division—JOSEPH DIXON CRUCIBLE CO.

Established 1827 Jersey City, N. J.

DIXON'S INDUSTRIAL SILICA-GRAPHITE PAINT

rotor strike or rest on the windings. The best practice is to build up blocking to the level of the lowest point of the stator bore, so that the weight of the rotor will come on the blocking before the rotor is entirely out of the bore. A long piece of pipe should be slipped over the short end of the shaft, taking precautions to protect the journal, and used to take the weight of the rotor as it is worked out of the stator—the pipe projecting through the bore and being held on the far side of the stator.

Squirrel-cage windings that are loose in the laminations should be tightened before the movement and vibration wear or break the bars. In many old machines it was the practice to insulate the bars from the laminations. Eventually this insulation crumbles with age or is burned out when brazing is done. Except in some high-resistance rotors it has been found that such insulation is unnecessary, since the resistance of the laminations is so great that the current follows the copper without the aid of insulation.

When the cage is loose it is usually possible to drive a thin maple stick beside or on top of each bar and thus tighten the cage. Peening the rotor teeth down to hold the cage tight is poor practice and can prevent the motor from giving the performance for which it was designed.

Parallel Operation of D.C. Generators

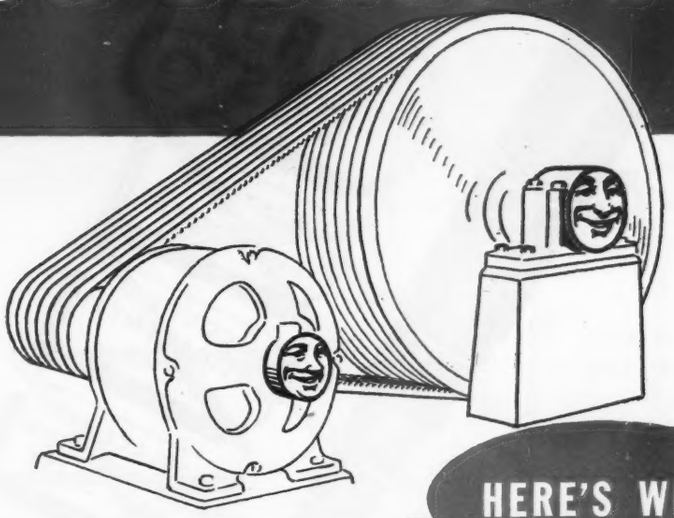
(Continued from page 67)

ally has few series coils and a low series resistance. The resistance of the series main may be an important factor.

To bring the resistances of the series circuits to the proper values so that the voltage drops in them will be equal at full load, resistors may be required. The nature of these resistors will depend on the currents to be carried and the voltage drops involved. They will vary all the way from a few steel washers inserted at some joint or contact point to quite formidable grid resistances.

Voltage at the equalizer terminal depends on the armature voltage due to the shunt field, the drop in the brushes and brush connections and in the interpole or compensating winding, and upon the speed of the engine. Speed of the engine usually

DAYTON COG-BELTS ARE EASY ON BEARINGS



GREATER GRIPPING POWER PERMITS LESS TENSION

The greater gripping ability of Dayton Cog-Belts in the pulley grooves eliminates all necessity for excessive tension. This relieves the strain on bearings and shafts, making motors and machines stand up longer without adjustments and repairs.

The Dayton Cog-Belt owes its tremendous pulling power to positive wedging action in the pulley groove. It is the only belt with patented, laminated construction which provides the crosswise rigidity needed for maximum wedging effect. With die-cut driving surface completely and continually in contact with the sides of the pulley groove, slippage is eliminated.

More than that, Dayton Cog-Belts are "built-to-bend." They have the greatest strength and stamina. They are quiet and clean. They save space. They last longer.

All of the many advantages of Dayton Cog-Belts are graphically illustrated and described in our big new book, "The A B C's of V-Belts." Write for your copy today.

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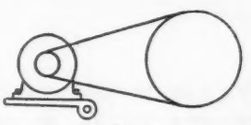
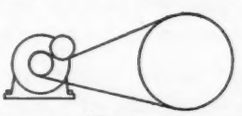
World's Largest Manufacturers of V-Belts

Manufacturers also of Dayton Fan Belts, Dayton Red Tube Radiator Hose, Dayton Thorobred Tires and Dayco Printers' Rollers

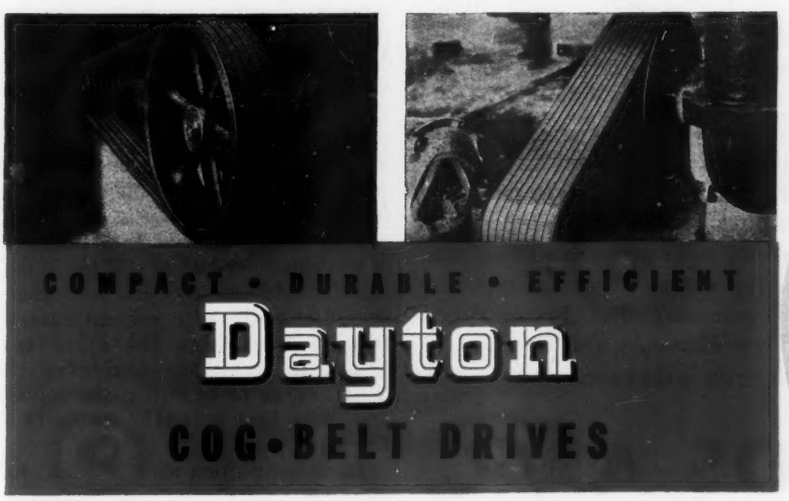
HERE'S WHY



Unnecessary to throw motor weight on Daytons to make them pull.



Nor are troublesome idler pulleys needed with Daytons.



COG-BELT DRIVES—F. H. P. V-BELT DRIVES—V-FLAT DRIVES—DAYCOIL OIL-PROOF V-BELTS—COMPLETE DRIVES, PULLEYS and BELTS IN STOCK

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Briefly, ROCKBESTOS wire is still new when ordinary wires have deteriorated to the point of failure. Its use practically eliminates wire failure and all the expense that comes with it. In addition, savings may be realized in footage because ROCKBESTOS can be run direct, regardless of heat, vibration, or other insulation destroyers. More than fifty different money saving constructions are described in our catalog. May we send you one? Rockbestos Products Corporation, 827 Nicoll Street, New Haven, Conn.

"ALSO REFER TO ELECTRICAL WORLD BUYER'S REFERENCE NUMBER OF DEC. 21, 1935, VOL. II."

ROCKBESTOS A.V.C.
the wire with permanent insulation

tends to decrease with increase in load. When synchronous motors drive the generators there is no speed change.

Trouble encountered only with interpole machines is sometimes caused by a compounding effect of the interpoles, which causes a rise of voltage inside the equalizer connection as load comes on. This difficulty may be overcome by shifting the brushes forward, in the direction of rotation. There is, however, a limit to the amount of this shifting. When the brushes are advanced they make contact at the commutator with armature coils that are not in the correct commutating field, and objectionable sparking at the brushes may result.

Resistor in Series

Other ways to overcome interpole compounding, rather than shifting the brushes, may be used. For example a resistor can be connected in series with the interpole winding to produce the desired voltage drop. This expedient is objectionable, however, because there is no suitable location or terminals for such a resistor and its use involves a waste of power.

A better way of accomplishing the same result is to apply a light bucking series field by adding another series winding, or by reconnecting the existing series coils so that some of them are inside the equalizer and oppose the shunt field. The effect of this change will be to counteract the boosting effect of the interpoles, without spoiling commutation and wasting power.

Designers are fully aware of the bad effect of interpole compounding and it will seldom be found in machines operated at or near their rated speeds and voltage. On the other hand, when conditions are different from those assumed by the designer, as when a machine designed for 250 volts is operated at 220 volts without a corresponding reduction in speed, the shunt field is weak, the interpole influence is more noticeable, and the compounding effect may cause trouble.

It is important that the resistance of the equalizer be low. When a machine tends to drop its load there should be nothing to prevent current from flowing from the other machines to its series field over the equalizer, so as to stiffen the voltage and make that unit take its share of the load.

Local conditions may be such that in order to get a low resistance equalizers are run directly between machines, rather than to the board.

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As the picture shows, LUX extinguishers blast out a blizzard of carbon-dioxide snow. It kills fire faster than any other extinguishing agent. Get an extinguisher that will handle the worst kind of fire. Then you have one that you can rely on, under all conditions. In a variety of sizes from 2 to 100 lbs. of gas capacity. LUX extinguishers are adaptable to your severest fire hazards.

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Write for your copy of new booklet, "Instant Death To Any Fire."

WALTER KIDDE & COMPANY
102 West Street, Bloomfield, N. J.

In such instances the equalizer switches are placed on the machine frames or on posts near them. This method is not to be recommended, however, because it complicates the work of the operators.

In general, if equalizers follow the same course to the board and are the same size as the mains, their resistance will be low enough for good operation. In recent years there has been evident a tendency to install equalizers only half as large as the mains. Some cases of poor paralleling have been cured by the installation of equalizers of suitably low resistance.

The series mains of parallel machines may at times carry currents different from their armature currents, due to the equalizer connection. The generator ammeter should therefore be connected in the armature main, never in the series main.

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BOOKS

CONTROL OF ELECTRIC MOTORS

P. B. Harwood, Engineering Supervisor, Cutler-Hammer, Inc. John Wiley & Sons, Inc., 440 Fourth Ave., New York. 383 pages and index. Illustrated. $4.50.

Describes characteristics of various types of motors, explains how these characteristics are used for control. Design, construction, and operating characteristics of different controllers are discussed, as are such problems as motor acceleration, dynamic braking, resistor design.

COST OF LIVING IN THE UNITED STATES, 1914-1936

National Industrial Conference Board, Inc., 247 Park Avenue, New York. 99 pages, including 14 tables. $2.50.

A study of changes in the cost of living of urban wage earners, this book provides a permanent record of the statistical information that the Board has issued on this subject.

ENGINEERING ALLOYS

Norman E. Woldman Ph. D., and Albert J. Dornblatt, Ch.E. American Society for Metals, 7016 Euclid Ave., Cleveland. 600 pages $10.

Consists of 8 sections. Section 1, alphabetical list of 8,200 alloys. Section 2, trade names, composition, properties, and uses of these alloys. Section 3, typical uses for 8,200 alloys. Section 4, alphabetical list of alloy manufacturers and alloys produced by each. Sections 5, 6, 7, and 8, bibliography, unclassified alloys, conversion tables, definitions, miscellaneous information about metals and alloys.

THE ECONOMICS OF OPEN PRICE SYSTEMS

Leverett S. Lyon and Victor Abramson. The Brookings Institution, Washington, D. C. 151 pages, appendix and index. $1.25.

Considers open-price systems in terms of economic and social issues and in terms of problems arising out of attempts to apply them to a given industry. Also concerns problems of constructing socially useful open-price systems and possible governmental relationships to their organization and operation.

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"Drilling and Surfacing Practice," by Fred H. Colvin and Frank A. Stanley, reviewed in September "Books," is published by the McGraw-Hill Book Co., Inc., 330 West 42d St., New York.